

# AMERICAN JOURNAL OF OPHTHALMOLOGY

THIRD SERIES FOUNDED BY EDWARD JACKSON

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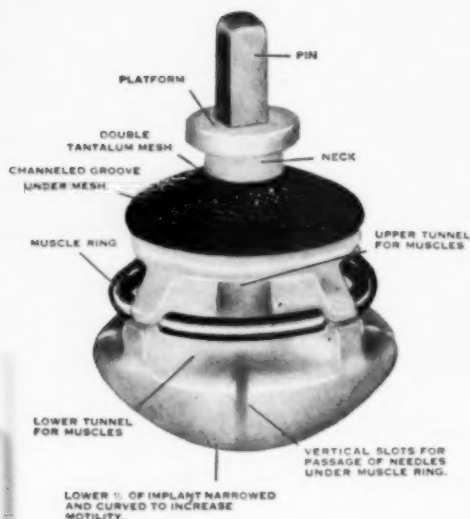
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Subscription price in United States ten dollars yearly. In Canada and foreign countries twelve dollars. Published monthly by the Ophthalmic Publishing Company. Subscription and Advertising Office: 664 North Michigan Avenue, Chicago 11, Illinois. Entered as second class matter at the post office at Menasha, Wisconsin.



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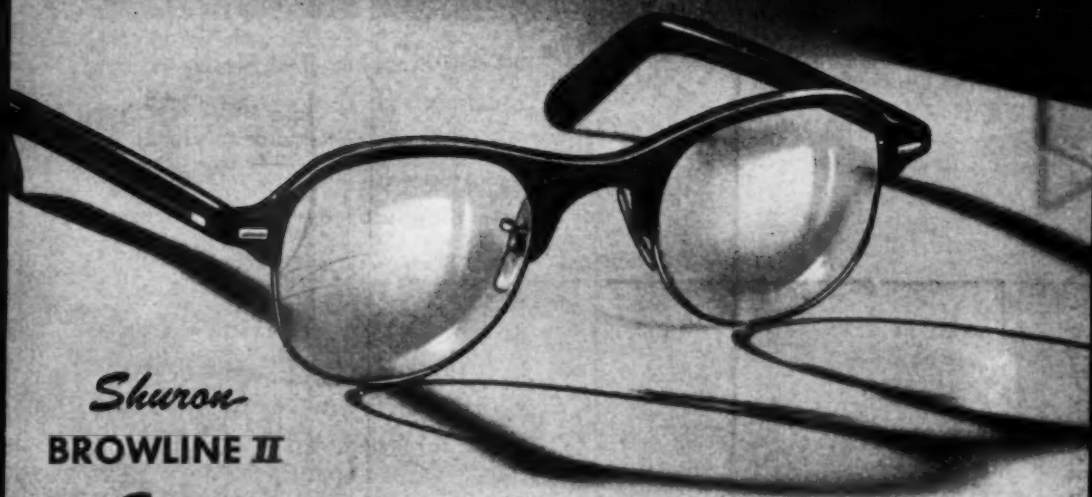
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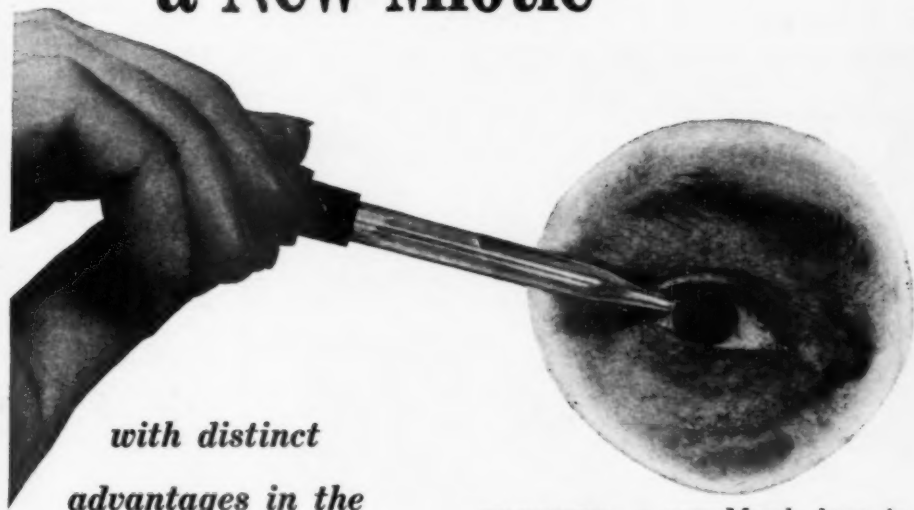
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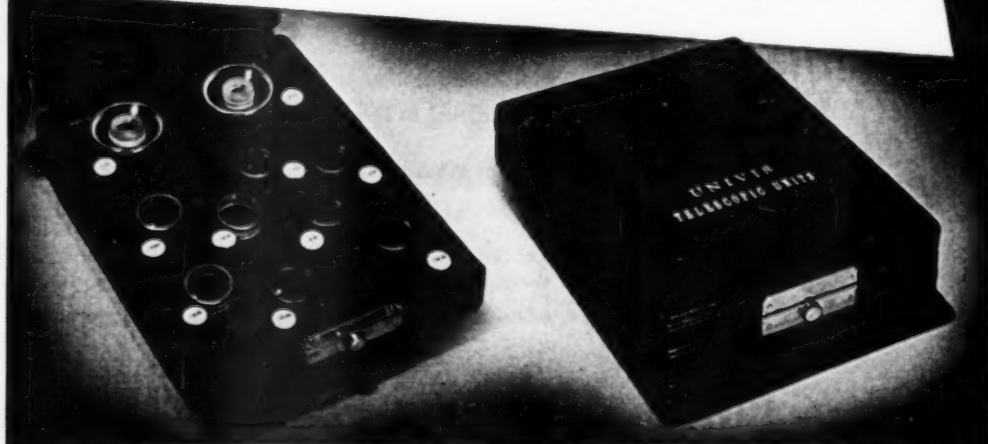
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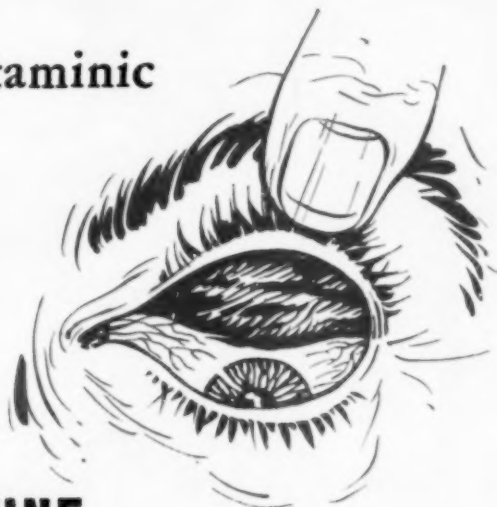
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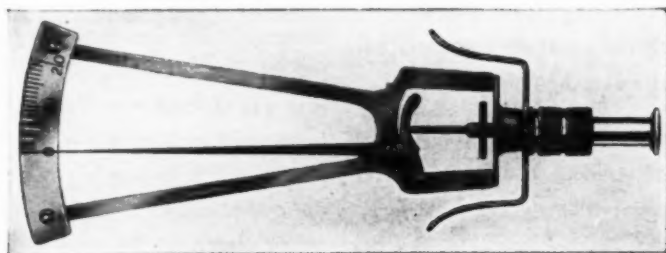
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SERIES 3 · VOLUME 32 · NUMBER 5 · MAY, 1949

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# AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 32

MAY, 1949

NUMBER 5

## STUDIES ON THE CLINICAL PHYSIOLOGY OF THE CORNEA\*

THE INTERRELATIONSHIP OF CORNEAL TURGESCENT, EPITHELIAL EDEMA, BULLOUS KERATOPATHY, AND INTERSTITIAL VASCULARIZATION

THE THIRD FRANCIS I. PROCTOR LECTURE†

DAVID G. COGAN, M.D.  
*Boston, Massachusetts*

It is the purpose of this address to present a resume of some recent experimental work on the cornea done at the Howe Laboratory and to point out the clinical significance of these primarily laboratory observations.

### TURGESCENT

Much of our original interest in corneal turgescence stemmed from the simple fact that an excised button of corneal tissue placed in almost any aqueous solution (including blood plasma or aqueous humor) had a capacity to take up water over and above its normal content far in excess of any other biologic tissue (fig. 1). It is an intriguing question to ask what are the factors preventing it from swelling in vivo and what function is served by this normal maintenance of a deturgescenced state of the cornea.

To answer these questions, Dr. V. E. Kinsey and I carried out a series of studies, at first on excised corneal buttons, then on excised whole corneas, and finally on corneas in vivo, with the following results: Corneal pieces immersed in solutions whose osmotic

pressure was varied over a wide range (0 to 2.0 molar) showed no inhibition of turgescence comparable to that which exists during life.<sup>1</sup> Likewise, corneal pieces placed in solutions of various hydrogen and hydroxyl-ion concentration similarly failed to show an in-

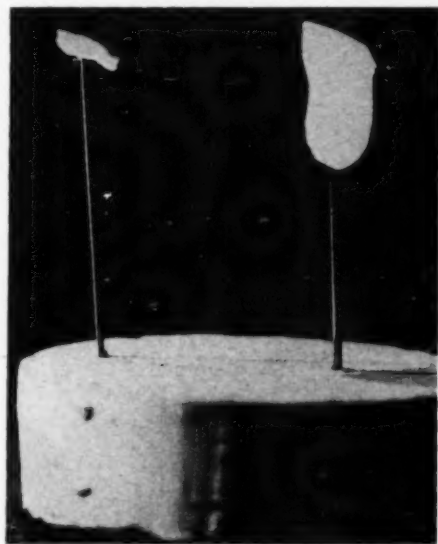


Fig. 1 (Cogan). Two buttons of cat corneas which had equal diameters when excised. The button on the left has been freshly excised; that on the right has been immersed in physiologic saline solution for several hours.

\* From the Howe Laboratory of Ophthalmology, Harvard University Medical School, and the Massachusetts Eye and Ear Infirmary.

† Presented before the University of California Medical School, San Francisco, September 10, 1948.

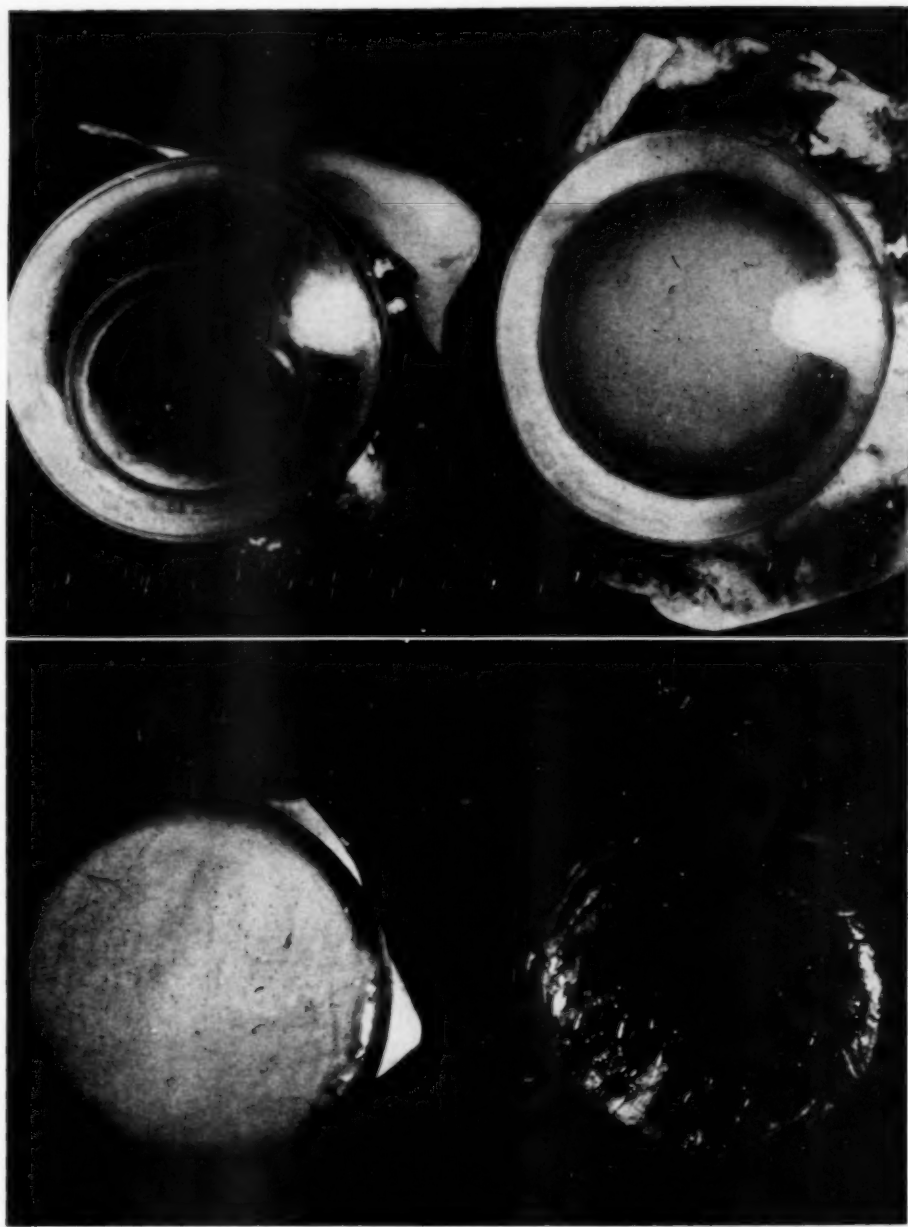


Fig. 2 (Cogan). Pictures showing relative opaqueness of cornea on hydration (above) and relative transparency of sclera on dehydration (below). The upper pictures are those of cat corneas which have been tied onto the ends of tubes (photographed end-on); the upper left has been kept relatively dehy-



hibition of turgescence over a range that might be considered to exist under physiologic conditions (pH 6 to 8).<sup>1</sup> Hydrostatic pressure had a definite inhibitory effect on turgescence, but the pressure necessary to maintain a state of deturgescence of the same order of magnitude as that which exists during life was much greater than could be accounted for by the normal intraocular pressure. Hence, it was concluded that the partially dehydrated state of the normal cornea was determined neither by the osmotic tension nor by the hydrogen-ion concentration of the interstitial fluid, and that the intraocular pressure was insufficient to account for more than a small part of it.

An explanation for the maintained deturgescence of the cornea was found, however, in a study of the permeability properties of the corneal epithelium and endothelium. While freely permeable to water,<sup>2</sup> these surface membranes were found to be extraordinarily impermeable to electrolytes<sup>3</sup> and to nonlipid soluble nonelectrolytes.<sup>4</sup> The semipermeability properties of the corneal epithelium (with respect to sodium chloride) were found to be far greater than for any other known biologic membrane and, indeed, approached those of a theoretically perfect semipermeable membrane. The corneal endothelium was less accessible for quantitative testing than was the epithelium but, in so far as it could be tested, it showed the same semipermeable properties as the epithelium.

In the presence of such effective semipermeable membranes, it is possible, therefore, to maintain a relatively deturgescenced state of the cornea by having fluid on the surface of the cornea hypertonic to that within the stroma. This may readily be demonstrated for the excised cornea where the

osmotic concentration of the fluid outside of the cornea can be made hypertonic at will and is presumed to apply *in vivo*<sup>5</sup> where the tear fluid on the anterior surface of the cornea and the aqueous humor on the posterior surface are believed to be hypertonic to that of the corneal stroma. According to this concept, the fluid within the corneal stroma is derived from the limbal blood vessels, and so long as the surface membranes of the cornea are intact and the fluids on the front and back surfaces of the cornea are hypertonic to that within the stroma, there will be continuously a net loss of water out of the cornea with consequent deturgescence of the stroma.

The function served by this deturgescence is transparency. To maintain transparency it is essential to keep the cornea relatively dehydrated. Since the structural and fluid components of the cornea have different refractive indices,<sup>6</sup> transparency will be approached only in so far as one of these components, in this case the fluid component, is kept at a minimum. The fundamental optical difference, then, between cornea and sclera (assuming the structural and fluid components of the sclera are also anisoincical) is due to the fact that the former has a dehydrating mechanism in its semipermeable membranes not present in the latter. In consequence, the sclera is normally hydrated to its maximum under physiologic conditions and therefore opaque, while the cornea is kept relatively dehydrated and transparent. But if the cornea is allowed to imbibe water fully, as is the case with the normal sclera, it becomes opaque; and conversely, if the sclera is artificially dehydrated so that, like the normal cornea, it contains only a fraction of the water capable of being imbibed, it also becomes transparent (fig. 2).<sup>7</sup>

---

drated by having epithelium intact and the fluid in contact with the epithelial side hypertonic to that on the stromal side; the upper right had the epithelium removed and is in consequence swollen. The lower pictures are those of albino rabbit scleras similarly tied onto the ends of tubes (photographed end-on); the lower left is the freshly excised sclera; the lower right has been allowed to dry in the air and is in consequence dehydrated and transparent.

#### EPITHELIAL EDEMA AND BULLOUS KERATOPATHY

Whereas maintenance of the normally deturgescenced state of the cornea requires an osmotic gradient such that the fluid on the anterior (and posterior) surface of the cornea is hypertonic to that within the stroma, epithelial edema and bullous keratopathy result when the osmotic gradient is reversed, that is, when the osmotic tension of the tear film becomes equal to, or less than, that within the stroma. This may be brought about ex-

ternally edematous and loose. Gross bullae develop, at first singly but, becoming confluent, raise up the whole epithelium in one large bulla that ultimately bursts.<sup>1</sup>

The determining factor in epithelial edema and bullous keratopathy of human beings is probably not a primary hypotonicity of the tears but rather an increase in the tonicity of the stromal fluid. This is brought about through endothelial damage with consequent percolation of hypertonic aqueous humor into the stroma. The development of the epi-

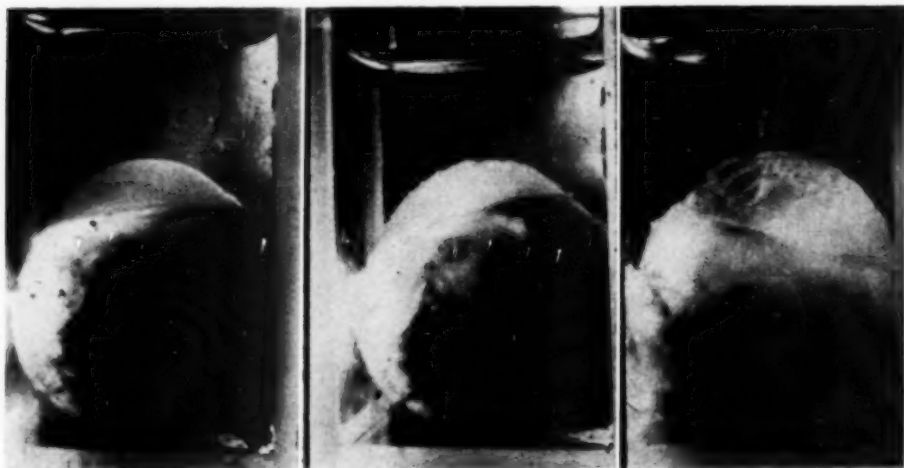


Fig. 3 (Cogan). Development of "bullae" in the enucleated cat eye by injection of three-percent sodium chloride solution into the anterior chamber and immersion of the whole eye into a flask of water. The pictures were taken at 5, 15, and 60 minutes after the injection.

perimentally by making the tear fluid hypotonic (placing water bath on eye) or by making the stromal fluid hypertonic (injecting 3-percent sodium chloride into the cornea or into the anterior chamber). The development of the bullae can perhaps be most strikingly induced by injecting hypertonic solutions into the anterior chamber of the enucleated eye and immersing the eye in a flask of water (fig. 3) or, alternatively, by tying the endothelial-less cornea on the end of a tube and making the fluid on the anterior or epithelial side hypotonic to that on the posterior side. The epithelium becomes uni-

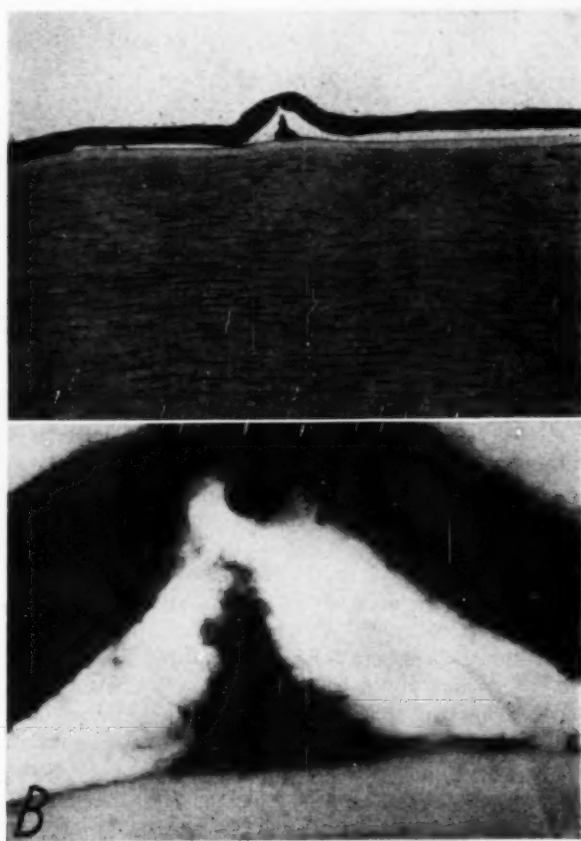
thelial changes will be influenced by a variety of factors. Noteworthy is the exaggeration of the edema by prolonged closure of the eyes (for example, after sleep) where the effect of evaporation in concentrating the precorneal tear film is reduced to a minimum. Moreover bullous keratopathy is infrequent where there is an open blood-aqueous barrier; it is found predominantly in conditions where the aqueous is believed to have an osmotic tonicity equal to or greater than that of the blood, as in primary keratopathies or with glaucoma. In other words, epithelial edema and bullous keratopathy are found

most marked where the osmotic tension of the tear fluid is less and where that of the aqueous humor or, more properly, that of the corneal stroma is greater than that of the blood.

It is possible to have swelling of the cor-

neal endothelium. In all these conditions the osmotic tension of the aqueous humor is presumably lower than normal since it approaches that of the blood. Conversely epithelial edema and bullous keratopathy might be expected to occur without swelling of the

Fig. 4 (Cogan). (A) Bullous keratopathy in a human eye three weeks after a perforating injury. The picture illustrates the looseness of the epithelium and the presence of subepithelial debris. (Low-power magnification.) (B). Same in high-power magnification. The subepithelial debris appears to be cytoplasm of the disrupted basal epithelial cells and contains free floating nuclei which are interpreted as being derived from the burst basal cells.



nea without epithelial edema or bullous keratopathy. Such might be expected to occur when, in the presence of endothelial damage, the blood-aqueous barrier no longer maintains the hypertonic state of the aqueous humor. Such swelling of the cornea without bullous keratopathy is indeed found to be the case with hypotony in instances of phthisis bulbi, chronic uveitis, and following a paracentesis when there has been an abrasion of

cornea in conditions wherein the stromal fluid became hypertonic through excessive movement of its water into the aqueous humor. Such may be the explanation for the epithelial edema in some cases of glaucoma. In other cases of glaucoma, however, the endothelium appears to have been damaged by the intraocular pressure, and the cornea becomes swollen as well as having edema of its endothelium.

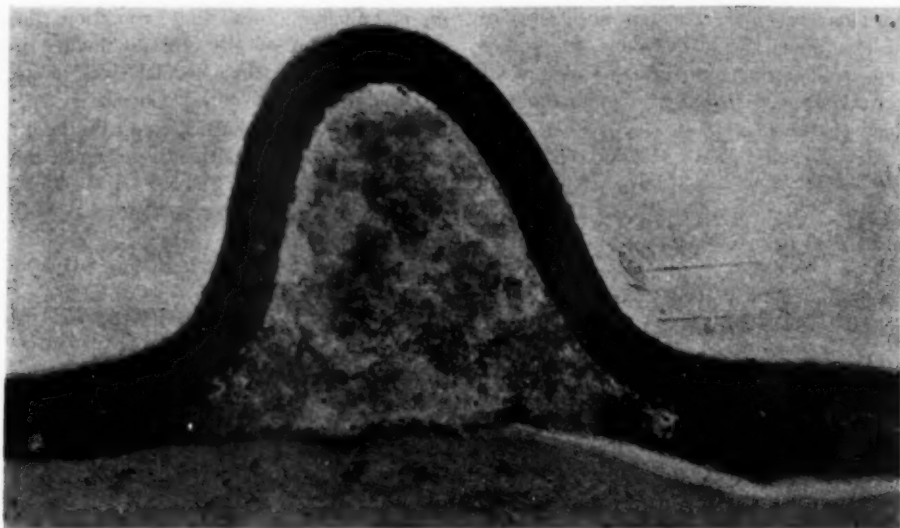


Fig. 5 (Cogan). "Bullous keratopathy" in the enucleated cat eye induced by injection of three-percent sodium chloride into the anterior chamber and immersion of the eye in a flask of water for one hour. The subepithelial debris appears to consist of ruptured epithelial cells and free floating nuclei.

By piecing together the observations in acute experimental bullous keratopathy and those in the subacute and chronic clinical variety, it is possible to reconstruct the chain of events which lead to the characteristic histologic picture of epithelial edema and bullous keratopathy.<sup>8</sup>

The initial changes in bullous keratopathy are the swelling of the basal epithelial cells (edema) and the accumulation of fluid between the epithelium and Bowman's membrane. The basal cells swell to the point of bursting and disgorge their cytoplasmic and nuclear contents beneath the epithelium forming, with the subepithelial fluid, a bulla (figs. 4 and 5). This amorphous debris in the bulla becomes invaded by cells which, although appearing to come from the epithelium, assume spindle-shaped processes and come to be laid down anterior to Bowman's membrane in a manner indistinguishable from connective-tissue cells (fig. 6). In the course of time these cells develop laminae of collagen not unlike that of true corneal tissue (fig. 7).

In interpreting the sections of any one case of bullous keratopathy, it is important to remember that this disease is characterized by cycles of activity. The aforementioned early changes consisting of epithelial edema and bursting of the basal cells with the production of subepithelial cytoplasmic debris and free floating nuclei are to be found only when the histologic sections are made through an area which was actively developing a bulla at the time of enucleation. During a quiescent interval the epithelium appears relatively normal, the outstanding abnormality being laminae of flattened cells and (depending on the duration) a varying amount of collagen separating the epithelium from Bowman's membrane or from the superficial stroma.

#### VASCULARIZATION

There appears to be a significant relationship between swelling of the cornea and new blood-vessel formation in the stroma of the cornea.<sup>9</sup> Neovasclogenesis occurs only when the corneal stroma adjacent to the

preëxisting vessels swells. Moreover, the morphologic changes in these vessels suggest that the initial events are induced by a reduction in the tissue compactness of the cornea. There is first a dilatation of the vessels, chiefly of the veins and capillaries, with saccular outpouchings of the vessel walls. Such dilatation must be brought about either by increase in the intravascular pressure or decrease in the extravascular pressure. There is no evidence to support the former, but the facts, that the dilatation occurs only as the area of swelling extends to the vessels and that the saccular outpouchings are to be found on the sides of the vessels toward the greatest swelling, support the assumption that the early morphologic changes are due to decrease in extravascular pressure.

It is to be remembered that the normal cornea is maintained in a state of compact-

ness by the unique deturgescing forces which operate on its surfaces. Swelling of the stroma appears to result in a reduction of this compactness and the evidence suggests this softening of the stroma is the factor precipitating the dilatation of the vessels. As the swelling of the cornea increases, the dilatation of the vessels increases until ultimately each of the saccular aneurysms bursts and numerous tiny hemorrhages can be seen extending into the adjacent stroma. The further sequence of events consists of a riddling of the hemorrhagic zone with new capillaries. Forming at first a profligate network, these ultimately become resolved into one or more loops with regression of the rest of the capillaries.

Obscure as are the factors responsible for the later stages, the early events of interstitial vascularization in the cornea appear to

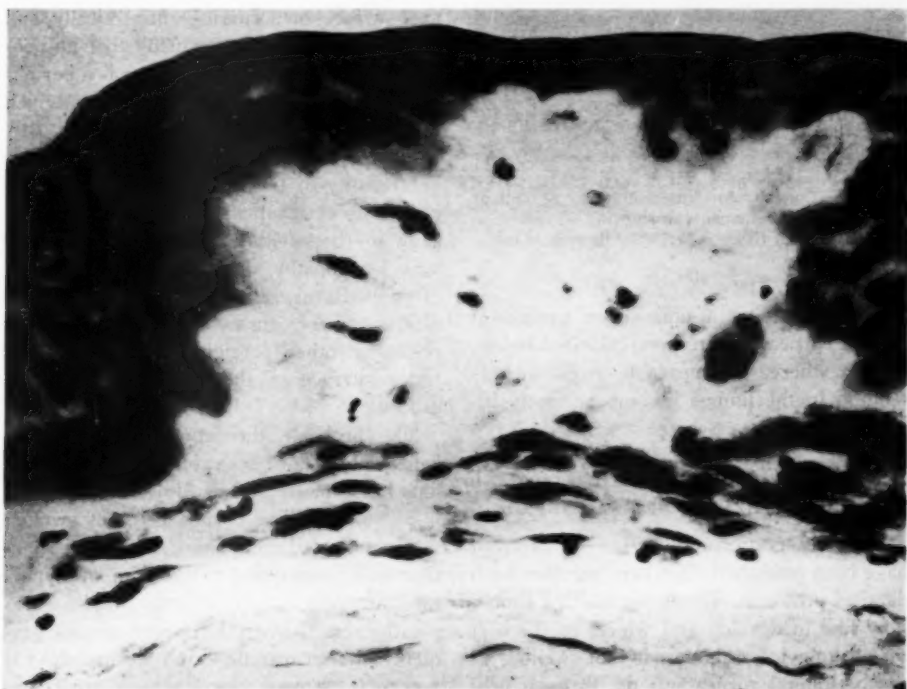


Fig. 6 (Cogan). An "active" bulla in a human eye. The cells within the bulla appear to develop spindle-shaped processes and come to be laid down in a stratified manner anterior to Bowman's membrane.

be initiated by the simple mechanical factor of softening of the adjacent stroma. It should be emphasized that it is the adjacent stroma which is important. Swelling of the axial portions of the stroma not extending to the limbus does not become vascularized. Thus swelling of the cornea in guttate dystrophy, long-standing glaucoma, and other

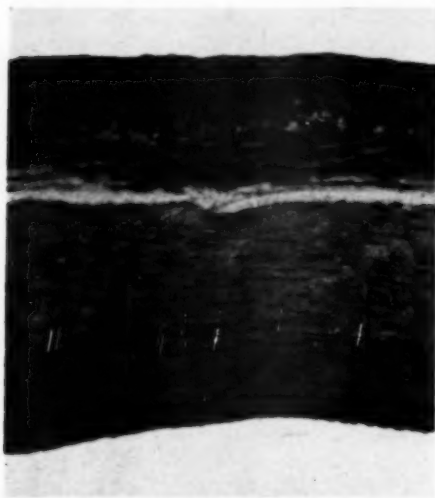


Fig. 7 (Cogan). An "inactive" stage of bullous keratopathy in a human eye showing stratification of collagen-rich tissue anterior to Bowman's membrane.

conditions having a nonswollen peripheral ring of cornea remain unvascularized indefinitely; whereas, comparable swellings extending to the limbus become promptly invaded by blood vessels.

#### TURGESCENT, BULLOUS KERATOPATHY, AND VASCULARIZATION OF THE CORNEA

The observations thus far enumerated have been published elsewhere together with detailed protocols. The thesis which I should now like to develop and which, to the best of my knowledge, is new is that swelling of the peripheral cornea sets up, through neovascularization, a cycle that is self-corrective. It is proposed not only that the swelling of

the cornea initiates the neovascularization but that the neovascularization in turn corrects the swelling and the accompanying bullous keratopathy.

The evidence for this is simply that corneas which are swollen and have bullous keratopathy become deturgesced as blood vessels grow into the stroma, while those corneas which do not develop interstitial vascularization are apt to remain swollen and bullous. Several examples of this may be cited.

Luetic interstitial vascularization shows a uniformly swollen cornea which becomes deturgesced as the new blood vessels grow in. The same phenomenon is strikingly seen in vascularization of the rabbit cornea. On the other hand, swelling of the cornea and bullous keratopathy are apt to be permanent when they accompany long-standing glaucoma, guttate dystrophy of the posterior corneal surface, or occurring idiopathically, and in these types it is noteworthy that no neovascularization occurs since there is a peripheral zone of nonturgid cornea across which the vessels do not pass.

On the other hand, swelling and bullous keratopathy of the *peripheral* cornea do become vascularized and, as the new vessels grow in, the swelling decreases, and the bullous keratopathy disappears. This is seen often in sclerokeratitis or in a variety of conditions where, through inflammatory deposits or other foreign material, the posterior surface of the peripheral cornea is eroded.

The probable theoretical basis for this beneficial effect of neovascularization on bullous keratopathy and swelling of the cornea is as follows. The cornea becomes swollen as a result of the impaired endothelial function with consequent percolation of hypertonic aqueous into the stroma. Bullous keratopathy results when the normal osmotic gradient between tear fluid and stromal fluid is reversed. As new blood vessels grow into the cornea, the stroma becomes more nearly isosmotic with the blood and therefore hypo-



tonic to the precorneal tear film. Then, in spite of persistent damage to the posterior corneal surface, water will be abstracted through the anterior surface with consequent cure of the bullous keratopathy and (so long as the water abstracted from the anterior surface of the cornea exceeds the net amount entering from the blood vessels and the posterior surface) deturgescence of the cornea.

It is, moreover, not impossible that the deturgescence in itself may be responsible for the subsequent collapse and partial obliteration of the blood vessels, through restoration of the normal compactness of the cornea, thereby completing the cycle of turgescence, vascularization, deturgescence, and devascularization. But it should be emphasized that this applies to interstitial vascularization only. There is no theoretical nor practical evidence to suggest that superficial vessels, such as occur in pannus, have any such deturgescing effect.

An analogy may be drawn between the dynamics of a vascularized cornea and that which normally obtains at the limbus. In both cases the stroma is in relatively intimate equilibrium with the blood and is relatively refractory to the development of corneal swelling and bullous keratopathy. Thus,

when the posterior surface of the cornea is abraded with a "magnetic flea," it is predominantly the central portions of the cornea which become swollen and opaque.<sup>10</sup> This is true even when the abrasions are made most markedly at the periphery. Similarly, experimental bullous keratopathy, induced by the injection of hypertonic salt solution into the anterior chamber, is much more marked in the normal cornea than in the vascularized cornea. In both instances it is presumably the equilibrium with the blood which maintains the relative hypotonicity of the stromal fluid and consequent deturgescence of the cornea.

From a practical point of view the obvious corollary of all this is that persistent swelling of the cornea and bullous keratopathy should be curable by inducing interstitial vascularization of the cornea. Such treatment will in itself induce some opacification of the media and whether or not it is indicated will depend on a number of factors such as persistence of the process, degree of discomfort, and visual acuity. To date I have employed it as a form of treatment in only a few cases and with equivocal results. I shall have to await further trial before drawing any practical conclusions.

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#### REFERENCES

1. Kinsey, V. E., and Cogan, D. G.: The cornea: III. Hydration properties of excised corneal pieces. *Arch. Ophthalm.*, **28**:272-284, 1942.
2. Cogan, D. G., and Kinsey, V. E.: The cornea: I. Transfer of water and sodium chloride by osmosis and diffusion through the excised cornea. *Arch. Ophthalm.*, **27**:466-476, 1942.
3. ———: The cornea: II. Transfer of water and sodium chloride by hydrostatic pressure through the excised cornea. *Arch. Ophthalm.*, **27**:696-704, 1942.
4. Cogan, D. G., Hirsch, E. O., and Kinsey, V. E.: The cornea: VI. Permeability characteristics of the excised cornea. *Arch. Ophthalm.*, **31**:408-412, 1944.
5. Cogan, D. G. and Kinsey, V. E.: The cornea. V. Physiologic aspects. *Arch. Ophthalm.*, **28**:661-669, 1942.
6. Verrijp, C. D., Duyster, C. B., and Ouwejan, A. J.: Corneal opacity. *Nederl. tijdschr. v. geneesk.*, **80**:2379-2384, 1936; abstract in *Zentralbl. f. d. ges. Ophthalm.*, **37**:158, 1937.
7. Fischer, F. P.: Die medizinischer Kolloidlehre im Beziehung zum Auge. *Zentralbl. f. d. ges. Ophthalm.*, **27**:657, 1932. Verrijp, C. D., and Duyster, C. B.: Observations on double refraction. *Nederl. tijdschr. v. geneesk.*, **79**:1986-1988, 1935; abstract in *Zentralbl. f. d. ges. Ophthalm.*, **34**:249, 1935.
8. Cogan, D. G.: Bullous keratitis: With particular reference to the pathology of experimental corneal vesiculation. *Arch. Ophthalm.*, **25**:941-968, 1941.
9. ———: Vascularization of the cornea: Its experimental induction by small lesions and a new theory of its pathogenesis. *Arch. Ophthalm.*, in press.
10. ———: A new method for studying endothelial regeneration: Biomicroscopic observations on normal and vitamin C deficient animals. *Acta ophthalm.*, in press.

## AN OPERATION FOR CHRONIC PRIMARY GLAUCOMA\*

GONIODIALYSIS COMBINED WITH SCLERECTOMY AND IRIS INCLUSION

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I am sure most eye surgeons have done this operation in part many times. The sclerectomy, the iris inclusion, the goniodialysis—all these have been done by many surgeons. I am suggesting only that all of these be done at one time and also that the incision be made by the ab externo route as originally advocated by Ernst Fuchs.

The operation is indicated for cases of chronic primary glaucoma either with or without acute exacerbations. It can also be used for the intractable borderline case of secondary glaucoma; that is, the case which is difficult to classify as true primary glaucoma and in which often more than one operation has been done with no permanent control of tension.

This operation has been done at Mt. Sinai Hospital and at the Manhattan Eye, Ear, and Throat Hospital on a total of 50 eyes of 43 patients, 20 of whom were men and 23, women. The ages ranged from 43 to 79 years. The duration of the glaucoma varied from 1 year to at least 8 years before operation. The tension before operation with miotics varied from 30 mm. Hg to 80 mm. Hg (Schiøtz).

The visual fields varied from almost normal to telescopic, with various sizes of paracentral scotomas and enlarged blindspots extending almost to fixation. In no case was the field made worse or the visual acuity impaired by the operation. No patients developed lenticular opacities as a result of the operation. Visual acuity before operation ranged from 5/400 to 20/20.

Some cases have been followed for three

years, and some for only one month. Three patients had had prior operations for relief of tension in eyes operated on by the method described in this paper. Of these three cases, one was a failure after 8 months with this operation. Any case which needed miotics after the operation more than 3 times a day to keep the tension normal was considered a failure. The one failure was in a Negro who had syphilis and whose right eye was lost following several unsuccessful operations to control the tension, including cyclodiathermy. The left eye had one operation for glaucoma with no reduction in tension, following which the operation I shall describe was performed by the surgeon in charge of the case. The tension was controlled for 8 months but then rose again and could not be controlled with miotics.

### OPERATIVE PROCEDURE

The operative procedure is simple and requires no great amount of surgical skill. It can be done under intravenous or local anesthesia. On the day of the operation, I use no miotics, in this way making it easier to withdraw the iris from the wound.

In the cases done under local anesthesia, I use a lid block according to Van Lint's technique, two sutures through the upper lid, and one through the superior rectus. No suture is needed for the lower lid. Two cc. of 2-percent novocain with adrenalin are injected retrobulbarly above and also some subconjunctivally above, ballooning up the conjunctiva between the limbus and the upper fornix.

The incision is made one centimeter above the limbus and rather wide, as one does for a trephination. Tenon's capsule is also opened rather wide. As one approaches to within 5 mm. of the limbus the incision goes through all the layers down to sclera. This

\* Presented with moving pictures before the Eye Section of the New York Academy of Medicine December 15, 1947; the Los Angeles Society of Ophthalmology and Otolaryngology and the Los Angeles Ophthalmological Society, March 9, 1948; the International College of Surgeons, Rome, Italy, May 18, 1948.

incision must also be made wide to avoid a small filtration area which would stand out like a knuckle.

The dissection is carried down to the corneoscleral margin and here a partial splitting of the cornea, as for a trephination, may be performed, only it does not have to be carried into corneal tissue for any considerable distance.

With a keratome or a knife, a 5-mm. incision is made through sclera, 2 mm. above the corneoscleral margin. This line is scratched deeper and deeper until the uveal tissue is reached. If scleral bleeding is annoying, it is easily controlled by applying thrombin topical on an applicator.

Then an iris reposer is inserted through the wound, hugging the under surface of the sclera. If the reposer does not enter easily, the incision with the keratome is repeated, going a bit deeper this time. The reposer is tried again and, as it enters, it is placed gently into the anterior chamber, entering through the iris angle. The reposer is swung gently from side to side opening the angle over as great an area as possible.

With a Stevens scissors, two incisions are made 3 mm. apart at right angles to the original scleral incision going down to the corneoscleral margin. This piece of sclera is then picked up in toothed forceps and excised.

The iris is then gently grasped with iris forceps near the pupillary margin and, with a gentle side to side swaying motion it is carefully, gently, and very slowly withdrawn through the scleral wound until the black pupillary portion is visible. One incision is made through half of the withdrawn iris to the pupil and this pillar allowed to recede. The other portion of the iris, which is still in the iris forceps, is allowed to lie on the sclera just as it falls. No attempt is made to straighten the iris or to place the pigmented layer of the iris against the sclera.

The conjunctiva is now closed with a



Fig. 1 (Laval). The ab. externo scleral incision is made 5 mm. long with the point of a keratome 2 mm. above the corneoscleral margin until the uveal tissue is reached.



Fig. 2 (Laval). An iris reposer is then placed in the wound, hugging the inner scleral surface, and gently continued forward until the reposer enters the anterior chamber. The reposer is then moved from side to side freeing the angle (gonio-dialysis).



Fig. 3 (Laval). Two incisions, 3 mm. apart, are then made in the sclera toward the corneo-scleral margin for a distance of 1 mm.

running silk suture; a knot is tied at both ends and the bites are taken rather closely together. In this way a tight closure is obtained and the ends of the suture can be

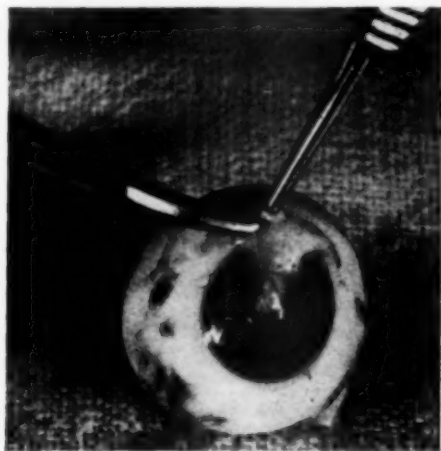


Fig. 4 (Laval). This piece of sclera is cut off with scissors giving a scleral opening measuring 3 by 1 mm.

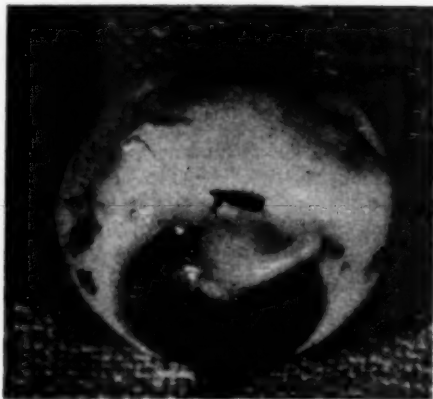


Fig. 5 (Laval). A scleral tongue 2 by 5 mm. has been excised. This has been made extra large for purposes of demonstration but in actual practice does not exceed 1 by 3 mm.

cut quite short. One drop of 1-percent atropine is instilled and the eye bandaged.

#### EXPERIMENTAL OBSERVATIONS

I was curious to know what structures my iris repositr traversed as it passed from the scleral incision, 2-mm. above the corneo-scleral margin into the anterior chamber. Accordingly, I obtained a normal globe from the Eye-Bank, made the scleral incision, and

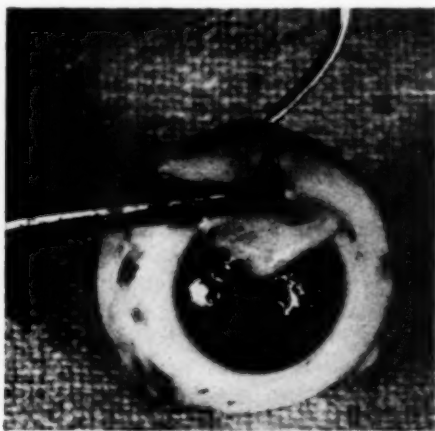


Fig. 6 (Laval). The iris is withdrawn until the black pupillary seam is seen; then it is cut half-way across.

inserted along the path of the repositor a piece of black silk suture material. The eye was fixed in Bouin's solution, sectioned, and stained with hematoxylin-eosin. Figure 9 shows the site of the scleral ab externo incision, (S) the suture material entering the sclera and passing through the ligamentum pectinatum (L).

In other words, the goniodialysis succeeds in cutting the trabeculas and freeing any anterior peripheral synechias, if present. A filtration tract is thereby formed connecting the anterior chamber through the angle with the outer surface of the globe. This tract is kept patent by the inclusion of iris tissue in the entire length of the channel. The length of the tract is cut in half by removing a 1-mm. piece of sclera, thus bringing the opening in the sclera near the filtration angle. Furthermore, by withdrawing and cutting the iris *after* the sclerectomy, the iris is cut directly at its root.

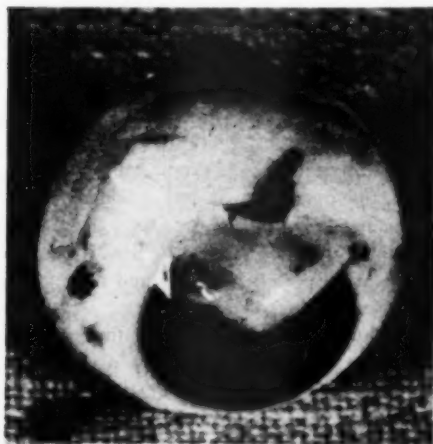


Fig. 7 (Laval). The iris which is in the forceps is allowed to lie on the sclera as it falls; no attempt is made to turn the pigment surface face up or down.

#### SUMMARY

The operation is advocated because: (1) It is simple and requires no great amount of surgical skill; (2) a thick covering of the filtration area is obtained instead of a very thin covering as in a trephination; (3)

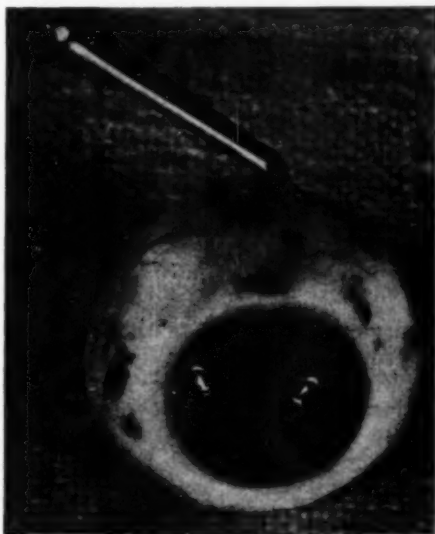


Fig. 8 (Laval). The conjunctival flap covers the iris.

regardless of the use of gonioscopy before the operation this procedure can still be carried out because the goniodialysis cuts through the filtration angle and any adhesions, if present; (4) by using the ab externo route for the scleral incision with the



Fig. 9 (Laval). Section of eye fixed in Bouin's solution and stained with hematoxylin-eosin. (S) Site of incision. (L) Ligamentum pectinatum. (M) Scleral meshwork. (Sc) Schlemm's canal.



keratome, the danger of injury to the lens is removed and one is also assured of making an unbeveled incision directly over the filtration angle; (5) the size of the scleral excision, which can be varied to suit the individual case, will be determined by the amount of tension with and without drops.

#### ADDENDUM

It is of interest to note here that an article recently appearing in the Brazilian ophthalmic literature reports an operation of simple goniodialysis executed in a manner somewhat similar to the one I have described, but without sclerectomy and without iris inclusion. The author, R. Granville,<sup>2</sup> performed the goniodialysis on 4 patients in 2 of whom the tension was satisfactorily controlled.

To accept the concept that a goniodialysis alone will reduce intraocular pressure one would have to suppose that enough of the aqueous in the anterior chamber cannot get into Schlemm's canal because the fibrillas of the meshwork of the filtration angle are so thickened and closely woven to each other as to block the aqueous at (L) in Figure 9. The remainder of the fibrillas of the meshwork (the scleral meshwork—M) would have to be normal in thickness to permit the aqueous to reach Schlemm's canal (Sc), which must also be considered patent and functioning. The goniodialysis makes an opening in the thickened arc of fibers at (L) and permits the aqueous to get to (M) where the spaces in the meshwork are sufficient in number and size for the aqueous to get into Schlemm's canal (Sc).

According to Barkan,<sup>1</sup> his technique of goniotomy for congenital glaucoma "makes the incision only in the meshwork of the filtration angle" and goes through the same thickened arc of fibers at (L) in Figure 9. The direction of the incision in Barkan's

goniotomy is from the anterior chamber outward through the thickened area into the supposedly normal fibers of the scleral meshwork. Schlemm's canal is not incised and, again, one must suppose that Schlemm's canal is normal and that the aqueous has been kept from Schlemm's canal only by the thickened area of fibers of the meshwork at the filtration angle.

Accordingly Barkan, in his goniotomy with the aid of a surgical contact glass, is accomplishing the same thing that I accomplish with the goniodialysis by the ab externo route (trabeculotomy as Barkan suggested). Believing this to be true, I have performed a goniodialysis over one third of the area of the filtration angle in a case of congenital glaucoma in which an earlier iris-inclusion operation had failed to control the tension.

The incision in the sclera extended over one third of the circumference of the globe, 2 mm. behind the corneoscleral incision. The iris retractor was inserted and the iris angle freed over this entire area. The conjunctiva was sutured with a continuous plain catgut suture with a knot at each end to insure tight closure. There was no reaction and the tension fell from 40 mm. Hg (Schiotz), before operation, to 20 mm. Hg (Schiotz), after the operation. It has remained at 15 mm. Hg (Schiotz) for the past three months. Of course, this is an absurdly short observation period but time and more cases will give the verdict.

Granville, the Brazilian ophthalmologist, was able to separate a large area of the angle through a 4-mm. scleral incision, but I found it difficult to manage and also quite indefinite of execution. My next case will have a series of three 5-mm. incisions about 5 mm. apart and, through these, the areas of goniodialysis can all be connected quite simply.

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#### REFERENCES

1. Barkan, Otto: Technique of goniotomy. *Arch. Ophth.*, 19:217 (Feb.) 1938.
2. Granville, R.: Goniodialise. *Revista Brasileira de oftal.*, 5: No. 4 (June) 1947.



## SUTURES USED IN CATARACT SURGERY: A REVIEW\*

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There has been a great deal written concerning the value of sutures as used in cataract surgery, and there will be a great deal more written regarding the relative merits of various sutures used in cataract surgery. The purpose of this paper is to present a review of the subject to date, with comparisons, rather than to introduce any new methods of technique.

Historically, according to Brown,<sup>1</sup> some form of surgical treatment for cataract dates back 2,000 years or more. This early form of treatment was crude in relation to present surgery, with couching and reclination being the methods of choice. Charles de St. Yves<sup>2</sup>, 1707, was probably the first to remove a lens through a corneal incision; however, this was on a lens previously dislocated into the anterior chamber following an accident.

It is generally felt that the honor and the credit should go to Jean Jacques Daviel,<sup>3</sup> 1745, as being the first to perform the modern cataract extraction. His method, as originally described, has not been changed to any great degree up to the present time.

The first to use a suture in the closure of a cataract incision was Henry W. Williams,<sup>4</sup> 1867, of Boston. Dr. Williams was the president of the American Ophthalmological Society and ophthalmic surgeon to the City Hospital of Boston. The first suture he described was corneoscleral in type, later to be modified by himself as a scleroconjunctival suture. It seems timely to present the following from the original article by Dr. Williams:

"The advantage of the corneal flap extraction may be much enhanced, and its dangers materially lessened, in my judgment,

by the use of a suture to retain in apposition the edges of the wound. Securing a more immediate union, we not only avoid ulceration of the border of the flap and prolapsus iridis with its attendant evils, but obtain the more prompt restoration of the fullness of the globe, and of the normal relations of its several parts, lessen the chances of irritation from pressure of any cortical fragments or remnants of capsule upon the delicate contiguous structures, and the occurrence of iridocyclitis. This suture, a single strand only of the finest glover's silk, passed through the edges of the wound by means of a very minute, short needle, held by forceps, can be tolerated, without detriment, even in the cornea; but at present I am disposed to extend the corneal flap at its apex a little way into the conjunctiva, so as to allow of the placing of the suture in this membrane, where it is more easily inserted than through the tougher corneal tissue."

Williams used the corneoscleral suture in 48 cases which he reported. In the same year probably the second surgeon to use the corneoscleral suture was R. Chisholm.<sup>5</sup> He reports its use in one case and should be given due credit for being an early advocate of suture in cataract surgery, although his name has long been forgotten in this connection.

Sutures of this type or of any type were not used to any extent until revived by Kalt,<sup>6</sup> in 1894. Even then the majority of ophthalmic surgeons were not in favor of using sutures and this feeling is not entirely dispelled today. Many arguments were raised against the use of sutures some of which were: the procedure was too time consuming, it might endanger the eye due to inflammation, the sutures were too apt to be cut during section, the procedure was too complicated. Some authors went so far as to say

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that the worry regarding sutures spoiled the thrill of a perfectly executed section. Gradually sutures became more accepted, and the discussion in the literature shifted from whether or not to use sutures to an attitude of what is the best type of suture to use. Actually there can only be a few basic types of procedures; but the modifications are legion.

The advent of adequate anesthesia in ophthalmic surgery has done much to advance the use of sutures; since, in the past, the element of time would not permit its use. As late as 1917, McCorry and Shanker,<sup>7</sup> writing in defense of the conjunctival flap (without sutures), felt that this added procedure did not take too long. Their time was from 1 to 3 minutes from start to finish (not counting dressing) for a cataract operation. E. E. Maddox,<sup>8</sup> feeling that adequate closure was necessary, advocated using, and did use for a while, newly melted wax, but the results not being uniform he gave this up for sutures, in 1911.

#### TYPES OF SUTURES

Ellett,<sup>9</sup> in 1921, felt there were only two main types of sutures to be classified; one in the ocular coats and a second as a conjunctival flap or bridge. This is inclusive but does not break the various types down to their actual finer points. The following five principal processes and their advocates, as presented by Bonfioli,<sup>10</sup> seem to cover suture types adequately:

##### *I. Conjunctival—Conjunctival*

A. Classic conjunctival flap—Arruga, Elschmig, Sinclair, and Tersion.

B. Conjunctival recovering—Faure, Van Lint, Federici, Birch-Hirschfeld, Clark, Villard, Bartels, Gifford, Olah and Wood.

C. Conjunctival bridge—Chuckie, Wenzel, Desmarres, Hazner, Lamb, Pavia, Dusseldorp, Patton, Eber, Pochissoff, Salaviev, and Slocum.

##### *II. Cornea—Conjunctival*

Frisch, Verhoeff, and Scandbygaard.

##### *III. Sclera—Conjunctival*

Derby, Walker, VanPoole, Horwath, Verhoeff, and DeVaul.

##### *IV. Corneoscleral*

Suarez de Mendoza, Kalt, Liegard, Piccaluga, Baldino, Saint-Martin, Stallard, Olmos, and Corboy.

##### *V. Corneoscleral—Conjunctival*

Frisch, Gomez, Marquez, Wolfe, McLeod, Rabinowisch, Stallard, Leech, Sugar, Lindner, McLean, Verhoeff, and Castroviejo.

The Van Lint<sup>11</sup> flap differs from the Kuhnt<sup>12</sup> flap in its manner of preparation rather than in its function, as both are functionally of the recovering type.

A Van Lint flap is made by a limbal incision, the conjunctiva is dissected back freely so it will slide over the incision and about one third of the cornea, being then sutured in its new position at the 3- and the 9-o'clock positions.

In forming a Kuhnt flap, the limbal incision is made similar to the Van Lint, and then a secondary incision is made in the conjunctiva a few millimeters above the limbus. The undermining is not carried out to the extent necessary for the Van Lint flap, as the secondary incision allows the free movement of the newly formed flap in its covering of the incision and of the cornea. The sutures are placed as in the Van Lint flap but not so far down, with the resultant flap covering a smaller area of cornea.

Figure 1 is self-explanatory for most of the conjunctival sutures; however, it is of interest to note that Van Poole<sup>13</sup> used preplaced sutures of human hair stretched across the cornea. Using this material he had no cases of corneal ulceration or inflammation, and he routinely removed the sutures on the 4th postoperative day.

Also of note is the untied conjunctival su-

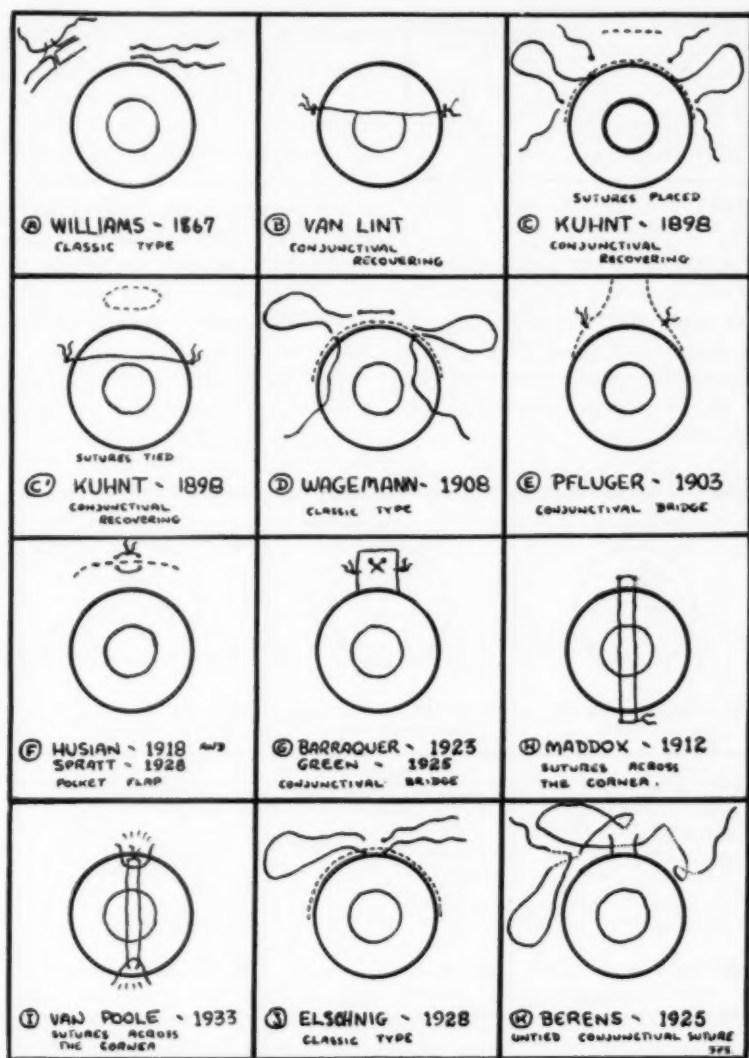


Fig. 1 (Bell). Examples of conjunctival-conjunctival sutures.

ture of Berens<sup>24</sup> which is placed after the section and conjunctival bridge have been completed. The suture is 45 cm. long and made of No. 3 twisted black silk impregnated with paraffin. It is introduced by means of a small curved cutting needle. Berens felt that the only contraindication to

the use of this type of suture would be extreme atrophy of the conjunctiva.

The scleral sutures as seen in Figure 3 may be divided into two types; those which are sclera-conjunctival as described by Verhoeff, Derby, and Horwath, and those which are sclera-sclera as to apposition of tissue,



Fig. 2 (Bell). Scandbygaard's two variations of cornea-conjunctival sutures.

with a secondary closure of conjunctiva. Examples of the latter type were described by Walker, DeVaul, and Hymes. All three of the sclera-conjunctival types have a small flap of conjunctiva turned down, and the suture is placed through sclera and conjunctival flap for closure.

In the sclera-sclera type with secondary covering by conjunctiva, the suture is pre-placed, both bites in scleral tissue. The manner of scleral preparation is different with each advocate of this type. Walker<sup>15</sup> attained an exact appositional suture by first making a scleral groove with a guarded cataract knife parallel to the limbus and 2 to 3 mm. back in scleral tissue. This groove went to about one third of the scleral depth and then a tongue of sclera was split out by means of a keratome incision in the lip nearest to the limbus.

DeVaul<sup>16</sup> makes a scleral tunnel with a cataract knife parallel to the limbus. The tunnel is divided in its long axis and then

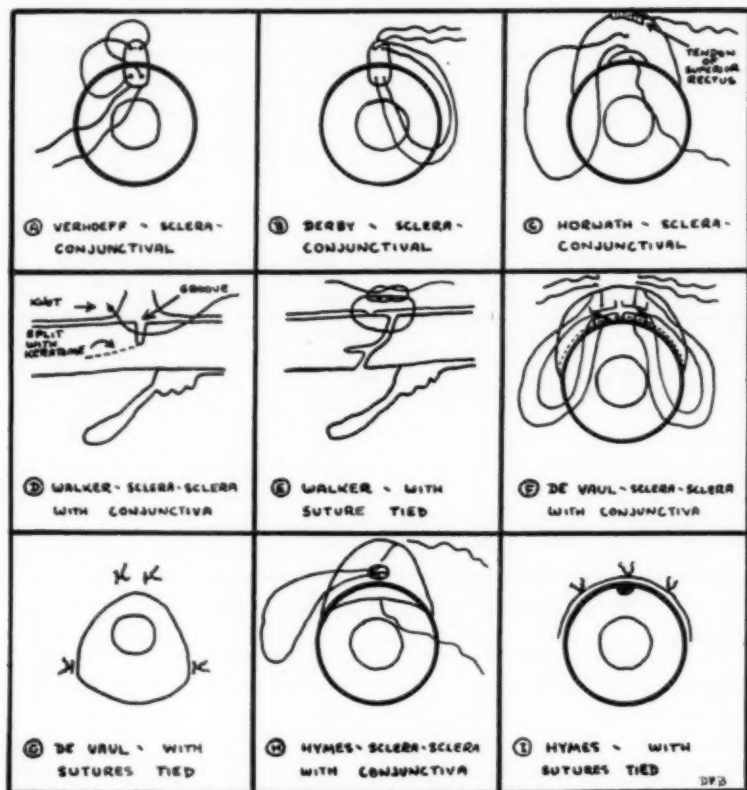


Fig. 3 (Bell). Sclera-conjunctival sutures and sclera-sclera sutures with conjunctiva incorporated.

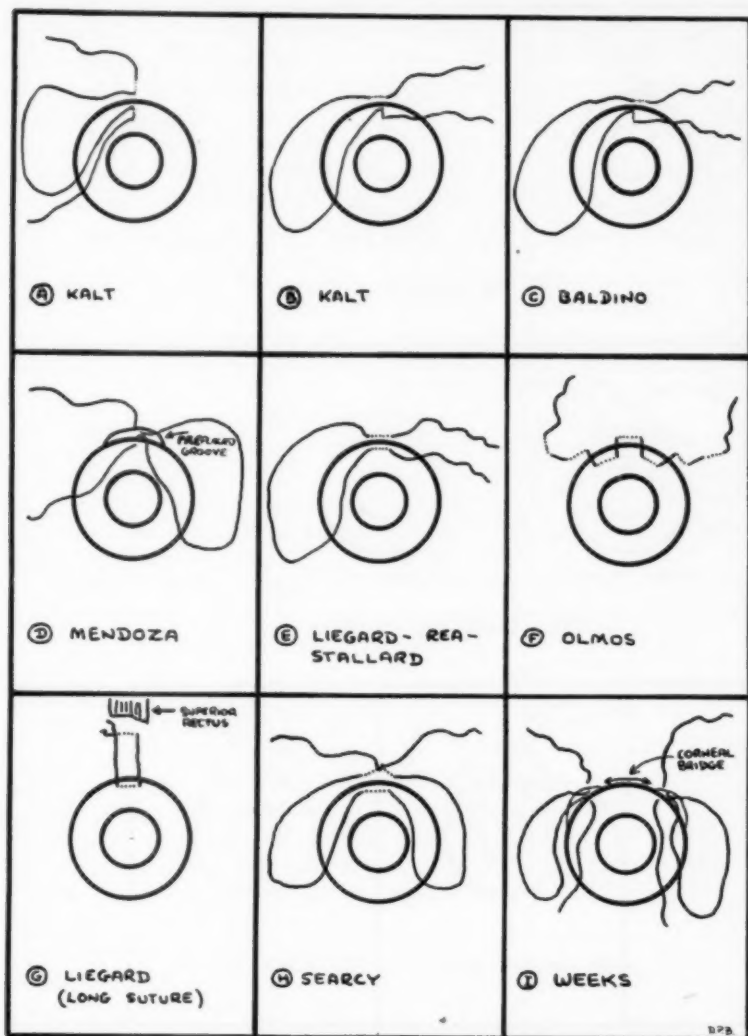


Fig. 4 (Bell). Corneoscleral sutures.

bisected to form four small flaps in which the sutures are placed. Hymes<sup>17</sup> makes a concentric wedge-shaped scleral flap at the 12-o'clock position by means of a concave scleral knife. This incision is closed with a single scleral-scleral suture and two conjunctival sutures.

Closure with scleral-scleral apposition

is more firm than with scleral-conjunctival. It is, however, somewhat more difficult to place the purely scleral type of suture according to DeVaul.

The corneoscleral suture as used today was very probably described first by Kalt<sup>18</sup> in 1894. The following is taken from his paper on the subject: "The suture consists

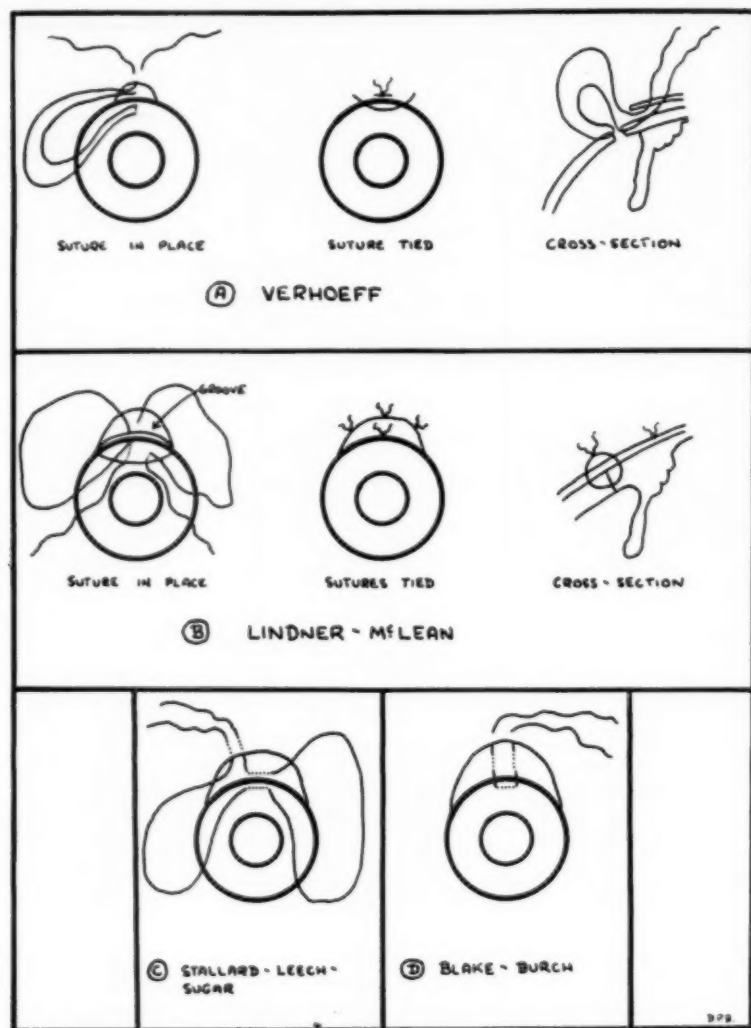


Fig. 5 (Bell). Corneoscleral-conjunctival sutures.

of a vertical corneal portion and a transverse episcleral portion. The whole forms a T with a gap between the junction of the horizontal with the vertical portion. The length of each of the portions does not exceed 1 mm. The vertical intracorneal branch follows the vertical corneal meridian and stops exactly at the junction of the transparent portion with the sclera. The horizontal portion traverses

the opaque part of the limbus as near the cornea as possible. An interval of 0.5 mm. corresponding to the limbus is ample to permit the passage of the knife."

From Figure 4 it is clear that the sutures of Kalt, Baldino, Liegard, Rea, and Stallard are all quite similar. Mendoza's differed from the previously mentioned sutures in that he used a preplaced groove. Olmos used



a complicated running type of suture with five scleral bites and two corneal bites while Searcy<sup>19</sup> used a single corneal bit with two scleral bites with the tie at the apex of the two scleral bites.

All of the above corneoscleral sutures are preplaced, while that of Weeks<sup>20</sup> differs in this respect. He makes the section, all except a corneal bridge at the 12-o'clock position, of about 2.4 mm. A small iris hook is then slid under the bridge and a corneoscleral suture is placed on either side of the bridge. The sutures are held out of the way and the section is completed by cutting the bridge with scissors.

In Figure 5 the first corneoscleral-conjunctival suture is one described by Verhoeff,<sup>21</sup> in 1927, and is a preplaced corneoscleral suture with a limbal flap allowed to retract away from the limbus. The suture may be inserted in more than one way according to the author. The third suture (C in Figure 5) is similar to the regular Stalard-type suture with the exception of the limbal conjunctival flap.

The suture termed the Lindner-McLean, which was described by McLean<sup>22</sup> in 1940, has a turn down flap 1 to 2 mm. from the limbus and extends from the 3- to the 9-o'clock positions. A small slot is made at the base of the flap with a Lundsgaard or other type of knife and extends about halfway through to the anterior chamber. The suture of fine black silk is run through the flap, reversed, and run back through sclera and cornea, coming across the preplaced groove or slot. This gives exact apposition of tissue (corneoscleral). More than one suture of this type may be preplaced as desired. The conjunctiva likewise may then be closed by additional sutures as desired. Figure 5-D is a transverse corneal bite with two vertical scleral bites augmented by a flap of conjunctiva incorporated into the closure.

#### TYPES OF SUTURE MATERIAL

Davis,<sup>23</sup> in a preliminary report (1944), mentions his use of 5-0 plain catgut after the section. A double knot cut short was

used and showed very little reaction except for some slight conjunctival edema in a few cases. Absorption was complete in 7 days and showed about the same amount of reaction as seen in other suture material. The author and his associates used plain catgut with good results in 70 cataract operations.

Hughes, Guy, and Romaine,<sup>24</sup> in 1944, made comparative studies using nylon, twisted and braided; plastic material, single strand and braided; 3-0 surgical gut, plain and chromic; and 5-0 surgical gut, plain and mildly chromicized. These materials were compared to 8-0 black surgical silk in the closure of cataract incisions, with the following conclusions:

1. Absorbable material probably more desirable and eliminated complications at time of removal.
2. The best size was 5-0, fine caliber, surgical gut.
3. Mildly chromicized gut held edges 14 days but caused objectionable reaction in tissues.
4. Plain surgical gut (5-0) held 5 days with only a slightly greater reaction than silk.
5. The knot is too bulky to be tied over corneal tissue.
6. Plain surgical gut (5-0) is not so flexible as silk but nearly approaches it. It is an advance but doesn't meet all requirements of the ideal suture.

#### EXPERIMENTAL WORK

In 1939, Hilding<sup>25</sup> felt that the handling of limbic incisions in cataract surgery had never been entirely satisfactory from the standpoint of preventing postoperative wound gaping and prolapse of the iris. He experimented with ox eyes, making various incisions and closures comparable to those used in cataract surgery. A manometer was used, making the measurements in millimeters of mercury, to determine at what pressure the iris would prolapse.

When a simple linear incision was used, the iris prolapsed at 30 mm. Hg pressure. With the incision covered by a conjunctival

flap, the iris prolapsed with 40 mm. Hg pressure and, when the lips of the wound were closed with one sclerocorneal suture, it took 240 mm. Hg pressure to prolapse the iris. Combining one sclerocorneal suture with an iridotomy, the iris could not be made to prolapse at the greatest pressure recorded on the type of manometer the author used. Hilding concluded that sutures placed directly in the lips of the incision, plus an opening in the iris, were effective in holding the wound closed and in preventing herniation of the iris.

Continuing his studies on the mechanics of iris prolapse and safety factors in cataract

corneoscleral sutures and 3 peripheral iridectomies) showed only half the amount of very tiny iris prolapses as did operation No. 2 (4 corneoscleral sutures and no iridectomies).

#### STATISTICAL STUDIES

Prior to the use of the suture which bears his name Stallard<sup>27</sup> had postoperative hyphemia in 30 to 35 percent of his cataract patients. In using this suture in 107 consecutive operations (79 extracapsular and 28 intracapsular cataract extractions) no hyphemia was seen in the postoperative period.

Visual acuity is one of the most important end results of cataract surgery. Klein,<sup>28</sup> in

TABLE 1  
COMPARISON OF COMPLICATIONS USING THREE TYPES OF WOUND CLOSURE\*

Type of Closure	Prolapse of Iris and Vitreous; Incarceration of Iris	Hyphemia	Anterior Chambers Not Reformed
Conjunctival flap without sutures	12 cases (8.0%)	9 cases (6.0%)	11 cases (7.3%)
Conjunctival flap with sutures	10 cases (6.6%)	17 cases (11.3%)	9 cases (6.0%)
Corneoscleral suture (Stallard type)	6 cases (4.0%)	7 cases (4.6%)	4 cases (2.6%)

\* Survey by Leech and Sugar.

closure, Hilding,<sup>26</sup> in 1945, reported on 187 cataract operations. He felt that the mechanics of iris prolapse were an intact iris over a sudden defect in the outer coat plus the pressure from the posterior aqueous, which then pushed the iris through the opening or incision. He is of the opinion that one corneoscleral suture will prevent gaping in roughly 25 to 35 degrees of arc of the incision. An iridectomy or iridotomy guards 5 to 10 degrees of the arc on either side from iris prolapse. Roughly, this would mean that, in the average incision of 140 degrees, one would use for protection at least 4 corneoscleral sutures or 6 to 8 iridectomies. However, in using combined protection at 5 points, 3 sutures and 2 iridectomies would provide adequate protection.

An interesting point of comparison was shown by Hilding in the two types of operations used in this series. Operation No. 1 (2

1939, reported that visual acuity was better with the Liegard suture or the flap section than with a Kuhndt apron-type of closure. In 1942, Klein<sup>29</sup> felt, in reviewing cases, that there was a greater incidence of hyphemia seen where sutures were used. However, since most hemorrhages occur on the 5th to 6th day and he removed the sutures on the 5th or 6th day, he felt there might be a correlation in these incidences. He felt that Stallard's suggestion of not removing sutures until the 14th day might prevent many cases of hyphemia.

An impartial survey of the records at the Illinois Eye and Ear Infirmary, by Leech and Sugar,<sup>30</sup> in 1939, disclosed some interesting facts. They wanted to see whether the suturing of cataract wounds was of value or not in preventing postoperative complications. In the study three types of cases were reviewed:

1. Those in which conjunctival flaps were used without sutures.

2. Conjunctival flaps with sutures.

3. Corneoscleral sutures (Stallard type).

One hundred and fifty histories for each of the above groups were tabulated with the following postoperative conditions being considered:

1. Prolapse of iris or vitreous or both.

2. Hyphemia.

3. Delayed closure of the anterior chamber.

Table 1 shows the complications they found with the various types of wound closures.

When the corneoscleral suture was used, Hilding<sup>31</sup> found the postoperative astigmatism in 62 percent of his cases to be 1.5D. or less. When patients with other preëxisting pathologic changes were eliminated, 90 percent had normal or near normal vision.

#### CRITERIA FOR THE CLOSURE OF CATARACT WOUNDS

In a survey of the literature, the criteria for the closure of cataract wounds by McLean<sup>32</sup> seem to be inclusive and are herein reproduced:

A. The suture should be inserted in solid corneal and scleral tissue and not in loose yielding conjunctiva.

B. The suture should be placed before the section is made and should not require extensive manipulation after the eye is opened.

C. It should go through, not over, the lips of the wound so as to give firm closure and exact preoperative apposition.

D. The entire wound should be covered by conjunctiva as an added protection and better surgical closure.

E. The method should not be too complicated for the average surgeon.

#### INSTRUMENTS AND SUTURES

The essentials for a proper wound closure in cataract operations are:

1. Adequate fixation with scleral forceps,

scleral pick, hook, or special instruments.

2. Sharp atraumatic needle and fine black-silk suture.

3. Needle holder of excellent design which will prevent turning of needle.

Ellett<sup>33</sup> stressed the fact of always using the best type of needle and suture; the needle to be curved and round rather than to have a cutting edge. To be firm, the bite of the needle should not be at the wound edge, but far enough back. His choice of needles was the semicircular, curved type of Kalt, Chevallereau, and Toulant, the length being from 18 to 12 mm.

To prevent slipping of the needle, Higgs<sup>34</sup> devised a modification of the Kalt needle holder. The tip is made with a convex upper jaw and a concave lower jaw which fits the curve of the needle.

It is generally agreed that the time to remove sutures is from 7 to 14 days postoperatively. A good and safe method for the removal of sutures is the one advised by Hilding.<sup>35</sup>

With good illumination and adequate anesthesia, they are removed in 7 days. The lid retractor is held in the left hand, and the scissors in the right hand are pointed upward and away from the cornea. Cut the sutures, lay down the scissors, and remove sutures with forceps, grasping each suture above the cornea and pulling toward the center of the cornea.

#### SUMMARY

There are dozens of sutures mentioned in the literature for the closure of cataract wounds. There are, however, only five main classifications based on types of insertion:

1. The conjunctival-conjunctival.

2. The cornea-conjunctival.

3. The sclera-conjunctival.

4. The corneoscleral.

5. The corneoscleral-conjunctival.

It is evident that many of the types described in the literature are actually minor modifications of types already in use. Since all of the sutures in use are designated by a

different surname, it makes for great confusion. To clarify some of the resulting confusion, it would seem advantageous to think in terms of tissue involved rather than in men's names. An anatomic nomenclature would make for greater simplicity and clarity.

The advantages of sutures over conjunctival bridges is best summed up by Elschinig:<sup>26</sup>

1. All work in the anterior chamber is made easier with sutures because of the improved exposure.

2. Wound closure with suture is much more secure both primarily and in the healing period.

3. Vitreous prolapse is often prevented.

4. There is less chance of infection.

5. With peripheral iridotomy and sutures, there is rarely an iris prolapse.

To the above list might be added:

1. There is less postoperative hyphemia when sutures are used.

2. There is less postoperative astigmatism.

3. There is a greater mobility for elderly

patients and less danger for those unable to cooperate.

## CONCLUSIONS

1. Some form of suture should be used in the closure of all cataract wounds. The principle of suturing wounds should be followed as dogmatically in ophthalmic surgery as it is in all other branches of surgery.

2. The corneoscleral (preplaced in groove) truly appositional type of suture seems to afford the most perfect closure.

3. Most of the comparison of types of sutures as reported in the literature is based upon clinical evidence rather than upon experimental evidence. At the present time, there is need for more experimental study, regarding sutures in cataract surgery.

4. At present, silk is the best form of suture material for use in the closure of cataract wounds.

5. Until overwhelming experimental and statistical evidence piles up in favor of the one perfect type, many types of wound closures will continue to be used.

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## REFERENCES

1. Brown, S. H.: Cataract: An historical review of its surgical treatment. *Am. Ophth., St. Louis*, 13:310-338, 1904.
2. St. Yves, Charles: *Memoires de l'Academie Royale de Chirurgie*, 1707.
3. Daviel, J. J.: Sur une nouvelle methode de guerir la cataracte par l'extraction. *Memoires de l'Academie Royale de Chirurgie*, 2:337, 1753.
4. Williams, H. W.: Cataract extraction operation. *Arch. Ophth.*, 1:98-102, 1869.
5. Chisholm, R.: *Richmond Med. J.*, 4:307, 1867.
6. Wurdemann, H. V.: Suturing of conjunctiva in cataract operation. *Am. J. Ophth.*, 7:943-946 (Dec.) 1924.
7. McCorry and Shanker: *Rai Pundit (India) Ophth.*, 13:420 (April) 1917.
8. Berens, C.: The united suture in cataract extraction. *Tr. Sect. Ophth. A. M. A.*, 1925, pp. 117-134.
9. Ellett, E. C.: Corneal sutures. *Arch. Ophth.*, 50:341 (July) 1921.
10. Bonfili, A.: As suturas na operacao da cataracta. *Revista Brasileira de Oftal.*, No. 2 (Dec.) 1945, p. 85.
11. Spratt, C. N.: The pocket flap in cataract extraction. *Am. J. Ophth.*, 11:347-351 (May) 1928.
12. Slocum, G.: Conjunctival bridge and suture in cataract extraction. *Arch. Ophth.*, 10:329-341 (Sept.) 1933.
13. Van Poole, G. McD.: A new stitch in cataract operation. *Am. J. Ophth.*, 16:788-789 (Sept.) 1933.
14. Berens, C.: The united suture in cataract extractions. *Tr. Sect. Ophth. A. M. A.*, 1925, pp. 117-134.
15. Walker, C. B.: Exactly appositional sutures in the cataract operation. *Tr. Am. Ophth. Soc.*, 27:51-62, 1929.
16. DeVaul, C. H.: A new and improved technique for the closure of cataract incisions. *Am. J. Ophth.*, 25:1079-1085 (Sept.) 1942.
17. Hymes, C.: Scleral flap incision with scleral sutures for the cataract operation. *Arch. Ophth.*, 34:374-377 (Dec.) 1945.
18. Kalt: Sutures. *Arch. d'ophth.*, 21:255, 1898.

19. Searcy, H. B.: Scleral-corneal—scleral cataract suture. *South. M. J.*, **34**:702-703 (July) 1941.
20. Weeks, C. L.: New corneoscleral suture technique. *Arch. Ophthalm.*, **27**:1199-1201 (June) 1942.
21. Verhoeff, F. H.: Corneoscleral—conjunctival suture. *Tr. Am. Ophthalm. Soc.*, **25**:48-53, 1927.
22. McLean, J. M.: New corneoscleral suture. *Arch. Ophthalm.*, **23**:554-559 (Mar.) 1940.
23. Davis, F. A.: Catgut sutures for closure of the deep corneoscleral wound in operation for cataract. Preliminary report. *Arch. Ophthalm.*, **31**:321-322 (April) 1944.
24. Hughes, W. L., Guy, L. P., and Romaine, H. H.: Use of absorbable sutures in cataract surgery. *Arch. Ophthalm.*, **32**:362, 367 (Nov.) 1944.
25. Hilding, A. C.: Efficiency of various wound closures in prevention of prolapse of the iris after cataract operations. *Arch. Ophthalm.*, **22**:177-192 (Aug.) 1939.
26. ———: Experimental and clinical studies on certain safety factors in closure of cataract incisions. *Am. J. Ophthalm.*, **28**:871-885 (Aug.) 1945.
27. Stallard, H. B.: A corneo-scleral suture in cataract extraction: Its technique and advantages. *Brit. J. Ophthalm.*, **22**:269-273 (May) 1938.
28. Klein, M.: Survey of wound closure. *Tr. Ophthalm. Soc. U. Kingdom*, **59**:293-305 (Pt. 1) 1939.
29. ———: Closure of the wound: Frequency of complications with different methods of extraction. *Brit. J. Ophthalm.*, **26**:93-117 (Mar.) 1942.
30. Leech and Sugar: Reduction of postoperative complications in cataract operations with corneo-scleral sutures. *Arch. Ophthalm.*, **21**:966-975 (June) 1939.
31. Hilding, A. C.: *Am. J. Ophthalm.*, **28**:871-885 (Aug.) 1945.
32. McLean, J. M.: New corneoscleral suture. *Arch. Ophthalm.*, **23**:554-559 (Mar.) 1940.
33. Ellett, E. C.: Use of the suture for cataract extraction. *Arch. Ophthalm.*, **17**:523-529 (Mar.) 1937.
34. Higgins, S. G.: Corneo-scleral suture. *Arch. Ophthalm.*, **26**:674-675 (Oct.) 1941.
35. Hilding, A. C.: Removal of sclerocorneal sutures. *Arch. Ophthalm.*, **24**:371 (Aug.) 1940.
36. Elschmig, A.: Corneal suture in senile cataract extraction. *Am. J. Ophthalm.* **11**:267, April, 1928.

## AMOUNT OF EYE MOVEMENT OBJECTIVELY PERCEPTIBLE TO THE UNAIDED EYE\*

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Several ophthalmic tests involve the examiner watching the patient's eye to determine whether the eye has moved, as in loss of fixation during campimetric or perimetric examination or during the determination of the angle kappa. Other tests, such as the cover test for squint and the transfer cover test for phoria, require the examiner not only to detect a movement of the patient's eye but also to determine the direction of the movement whether up or down, right or left.

When the examiner, as is ordinarily the case, is using his unaided eye, what accuracy can be expected of such tests? In order to throw some light on these and similar problems, a simple investigation was

performed to determine the amount of eye movement objectively perceptible to the unaided eye.

Eye movements of various magnitudes were produced as follows. The examinee was seated facing a wall, 3.5 m. distant, on which was fastened a white sheet of paper at eye level. On the paper, in ink, were printed five dots in a horizontal row. The dots subtended 3 minutes of arc at the examinee's eye and the distance between the centers of two adjacent dots subtended 14 minutes of arc. The examinee fixated the center dot and on signal from the examiner, transferred fixation from the center dot to one of the other four dots. Thus, excursions of the examinee's eyes of 14 or 28 minutes of arc to left or right were obtained.<sup>†</sup>

\* From the Howe Laboratory of Ophthalmology, Harvard University Medical School, and the Massachusetts Eye and Ear Infirmary. This investigation was supported in part by a grant from the American Optical Company.

† Excursions of as little as 10' or as much as 57' were occasionally produced for particularly good or poor examiners.

The examinee determined the direction and magnitude of each excursion by reading it off the top card of a pack which was shuffled before each series of observations. The examiner, seated facing the examinee, stated after each excursion in which direction the eye had moved. If in doubt, the examiner was forced to guess. An analogous procedure was carried out with the dots in a vertical row.

Each examiner selected what he considered to be ideal conditions for the observation. The room could be partially darkened, movement in the background or periphery was eliminated, some examiners

judgments was computed. The results are presented in Table 1.

Results vary from day to day and from examiner to examiner. In this investigation the same examinee was used for all examiners. It seems likely that the eye movements of some individuals are more readily perceived than are those of others.

It may be seen from the figures given in the table that vertical movements appear to be more difficult to discern than horizontal movements but this may well be attributable to chance since application of the *t*-test<sup>2</sup> shows that  $P > 0.2$ .

The results show, in general, that, even

TABLE 1  
RESULTS IN TESTS OF EYE MOVEMENT PERCEPTIBLE TO THE UNAIDED EYE

Examiner	Horizontal Movement in $\Delta$ Necessary for		Vertical Movement in $\Delta$ Necessary for	
	95% Correct	99% Correct	95% Correct	99% Correct
A	1.9	2.5	1.3	1.7
B	.6	.8	1.0	1.3
C	.9	1.1	2.0	2.6
D	1.2	1.6	.6	.8
E	.6	.8	.8	1.1
F	2.0	2.6	1.0	1.3
G	.9	1.2	.8	1.0
H	.6	.8	1.1	1.4
I	.8	1.1	2.3	3.0
J	.6	.8	3.2	4.2
K	.6	.8	1.0	1.3
Average	1.0	1.4	1.4	1.8

used flashlights held in their hands or clamped to a stand. Some examiners gave the signal to change fixation by tapping rather than orally since they believed the jaw movement involved in saying "now" hindered observation.

The classical method of right and wrong cases<sup>1</sup> was employed to determine the probable errors of the data and from these the amount of eye movement necessary to produce 95-percent and 99-percent correct

under ideal conditions, excursions of much less than  $1^\Delta$  to  $2^\Delta$  cannot reliably be perceived by the unaided eye. In usual clinic conditions and with much less coöperation from the examinee, it seems advisable to adopt at least the upper limit of  $2^\Delta$ . This means that if it is desired to detect eye movements of  $1^\Delta$  or less, either a subjective test should be employed or the examiner should use magnification.

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#### REFERENCES

1. Guilford, J. P.: *Psychometric Methods*. McGraw-Hill, New York, 1936, p. 194ff.
2. Fisher, R. A.: *Statistical Methods for Research Workers*. Oliver & Boyd, London, 1938, p. 120ff.



# REGENERATION OF NERVES IN EXPERIMENTAL CORNEAL GRAFTS IN RABBITS\*

## CLINICAL AND HISTOLOGIC STUDY

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The various factors which influence the final clarity of a corneal graft cannot be properly evaluated until it has been determined whether the elements of the donor cornea are replaced or survive. In a previous study,<sup>1</sup> histologic examinations of clear corneal grafts, stained with hematoxylin and eosin, revealed that the donor's corneal lamellae and Descemet's membrane were not replaced.

There was no destruction or replacement of a large number of stromal cells at any one time, but it could not be determined whether there was a gradual replacement of these cells or not. Endothelial cells were always found on the grafts 4 to 5 days after operation, but it was impossible to determine in all cases whether these cells had migrated from the recipient cornea or belonged to the donor cornea.

The epithelium of the graft always sloughed and was replaced in 4 to 5 days by cells from the recipient epithelium. The fate of the corneal nerves was not discussed in the previous report because these structures were not visible in routine histologic preparations. The following report is based on a study of the clinical sensitivity of grafts to touch and histologic examinations of silver-impregnated frozen sections of corneal grafts.

## REVIEW OF LITERATURE

Clinical and histologic reports on corneal grafts both in man and experimental ani-

mals have been numerous, but regeneration of corneal nerves into the tissue has not been extensively investigated. The sensibility of corneal transplants has been studied by several investigators, but the results of these workers have differed slightly.

Ascher<sup>2</sup> found that sensibility returned in two clear grafts but did not return in cloudy grafts. In one patient with a staphyloma of the cornea a whole corneal transplant was done. The graft became completely opaque except for a small translucent area in the center. In this case the graft was insensitive except for the small central translucent area.

Elschnig<sup>3</sup> stated that complete sensibility of the implant did not develop even in the oldest cases of transparent implants, but a sensibility to heavy touch was observed. Imre<sup>4</sup> noted that sensibility of the graft returned 10 to 12 months after operation.

Morone<sup>5</sup> was able to detect the return of sensibility in both clear and cloudy grafts one year after operation. He thought the return of sensibility did not depend on the degree of clarity, course of healing, or vascularization of the graft. He also observed that the host's cornea became hyposensitive following operation. Morone stated that Magitot believed the sensibility of the graft is connected with vascularization.

Thomas<sup>6</sup> tested 29 experimental grafts in rabbits and found no return of sensibility in 5 grafts which remained clear, but 21 of the 24 grafts which were cloudy did regain some sensibility. Thomas concluded that the ingrowth of blood vessels was essential for the return of sensibility to the transplant.

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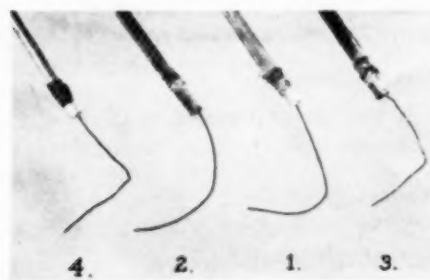


Fig. 1 (Kornblueth, Maumenee, and Crowell). Test object for determination of corneal sensitivity. (1) Equivalent to pressure of 25 mg. (2) Equivalent to pressure of 100 mg. (3) Equivalent to pressure of 300 mg. (4) Equivalent to pressure of 1,000 mg.

Galante<sup>7</sup> observed 8 translucent to opaque heterografts in dogs and rabbits and found that the transplants became sensitive at the periphery 10 days after operation. At the end of one month the sensibility of the grafts was equal to that of the recipient corneas.

Histologic studies for nerves in corneal grafts have been made less frequently than clinical observations on the return of corneal sensibility.<sup>3</sup>

Babel and Campos<sup>8</sup> and Franceschetti and Babel<sup>9</sup> have reported histologic studies of nerves in grafts. In their first publication they examined four opaque human transplants which were removed in order to insert second grafts. In one of these grafts, removed 36 days after operation, no nerves were found. The remaining three grafts were removed from 10 months to 7 years after transplantation. In these specimens nerves were found entering the grafts adjacent to invading blood vessels deep in the stroma, but no nerves were found in the subepithelial region in any of the grafts.

In their second paper they reported a study of a clear human transplant obtained 7 years after operation. In this case they

found a well-developed subepithelial nerve plexus in the graft, but there were no nerves in the deeper structures except in one area where a few blood vessels had entered the margin of the graft. From these studies they concluded that, if a graft does not become vascularized, nerves other than those of the subepithelial plexus do not invade the tissue. They also suggested that the ingrowth of nerves into the subepithelial region of the graft might be essential for the continued clarity of a transplant.

#### EXPERIMENTAL OBSERVATIONS

All of the grafts used in the present investigation have been partial penetrating, full-thickness homografts in rabbits. The grafts were cut with a 4.5-mm. trephine blade attached to a dental drill. The transplants were held in place by continuous criss-cross corneal sutures inserted into the recipient cornea as closely as possible to the edge of the graft. The sutures were removed on the 7th postoperative day.

a. *Clinical study.* The clinical sensibility of 12 clear and 10 cloudy grafts has been tested by touching the grafts and observing the blink reflex. The hairs near the eyes were clipped before examination to avoid a false blink reflex caused by touching these structures. The materials used for testing the corneal reflex were somewhat similar to v. Frey hairs. Pieces of sutures 2 cm. long were secured to match sticks and were bent to a right angle at 1 cm. from the tip of the suture (fig. 1). When the tip of the bent suture was pressed with maximal force onto a weighing pan of an analytical scale the first was just strong enough to lift 25 mg., the second 100 mg., the third 300 mg., and the fourth, 1 gm.

The blink reflex is admittedly not a very accurate test of corneal sensitivity in rabbits; nevertheless, it gave a general idea of the degree of sensibility of the grafts. The results obtained were about the same in the clear and cloudy grafts. The transplants were insensitive until about the 4th to 6th

<sup>3</sup> After this report was submitted for publication, an excellent study on degeneration and regeneration of nerves in corneal transplantation by Humberto Escapini was published in the *Arch. Ophth.*, 39: 135, 1949.

week after operation, then they developed a slight sensibility to pressure (300-mg. test object) in the periphery of the graft. This gradually spread over the graft and by the 11th to 13th week the grafts became sensitive to lighter touch (100-mg. test object). On the whole the grafts did not regain as complete sensibility as the surrounding normal cornea.

These clinical observations on corneal transplants correspond well with the recent work of Marcus Jent.<sup>10</sup> In 1945 he made a careful study of the regeneration of the corneal nerves in rabbits following an incision through the cornea around the entire periphery down to Descemet's membrane. In these experiments he found that the sensibility of the cornea returned first to the cicatricial ring in about 4 weeks and then gradually progressed over the entire cornea.

b. *Histologic study.* Seventeen clear and 13 cloudy grafts removed from two days to one year after operation were examined. No appreciable difference was found in the regeneration of the nerves in the clear and cloudy grafts. There was a variation of the ingrowth of the nerves from animal to animal but on the whole the invasion of the nerves and further developments coincided within a week to two weeks in all specimens.

Perpendicular and horizontal frozen sections were made on equal halves of the grafts and surrounding corneas. The staining method used was essentially the same as Campos's modification<sup>11</sup> of the silver impregnation technique of Bielschowsky and Gros. The slight modification of Campos's method devised by one of us (J. E. C.) gave good and uniform staining of the corneal nerves. The details of the technique used follow.

#### DETAILS OF TECHNIQUE

1. Fix the whole eye for 24 hours or longer in neutral formalin, 10 percent (formalin neutralized to pH 7.4 with aqueous calcium oxide not more than 0.1 percent. Filter aqueous calcium oxide before neutralization).

2. Remove cornea from globe.

3. Wash cornea in running tap water 1 to 2 hours, then wash in distilled water. Change distilled water every half hour for 6 hours.

4. Cut frozen horizontal sections 50 $\mu$  and collect in distilled water. Vertical sections should be cut 75 to 80 $\mu$ .

5. Mordant overnight (about 18 hours) in solution of silver nitrate (10 to 15 percent) in the dark.

*The following steps are facilitated by placing the sections in 50-cc. beakers. Add and decant the various solutions.*

6. Wash in distilled water and decant as quickly as possible (15 to 30 seconds).

7. Wash in 3 changes of neutral formalin (1 percent). Add about 10 cc. of neutral formalin for each washing. Total time, 2 to 3 minutes. Formalin will become brown or turbid occasionally during washing.

8. Wash sections in silver ammonium solution and decant immediately. (This is done to remove any trace of formalin which may have remained in beaker. Formalin in the presence of silver-ammonium solution will cause sections to turn bright yellow.) Add 10 cc. of silver-ammonium solution and allow sections to soak for one hour. Decant. (The silver ammonium solution is prepared as follows: Concentrated ammonium hydroxide is added slowly to 10 to 15-percent silver nitrate until precipitate is completely dissolved. Agitate constantly while adding ammonium hydroxide. After precipitate is completely dissolved, add an excess of one drop of ammonium hydroxide per cc. of solution. Prepare fresh each day and keep in tightly stoppered dark bottle.)

9. Add 10 to 15 cc. of 0.5-percent neutral formalin to sections. Stir or shake until sections become a uniform light yellow-brown color. If color is slow in appearing (longer than one-half minute) decant and add 1-percent neutral formalin. If the proper color still does not appear, decant and add 2-percent neutral formalin. The latter step (2-percent neutral formalin) is seldom necessary. Check sections under microscope. Nerve fibers and nuclei should be dark brown, stroma colorless.

10. When sections have the desired tint, wash them in running water (drop by drop) for a half hour. Cover beaker with layer of gauze to prevent loss of sections.

11. Wash in 20 cc. distilled water for two minutes.

12. Tone with gold chloride (2 drops of a 1-percent aqueous solution of gold chloride to 5 cc. of distilled water) until brown nerve fibers and nuclei are colored dark gray to black.

13. Fix in 5-percent sodium thiosulfate for 1 to 2 minutes.

14. Wash in distilled water. Dehydrate in 80-percent, 95-percent, and two changes of absolute alcohol. Clear in thin cedarwood oil and mount in balsam.

Histologic examination of the stained

sections revealed the following general pattern of reaction of the corneal nerves after keratoplasty.

During the first 3 days after operation the nerves in both the graft and the surrounding cornea began to show signs of degeneration in the form of segmentation, lighter staining and curling of the fibrils, and finally disappearance of the nuclei of Schwann's sheath cells (fig. 2).

penetrating the scar and entering the margin of graft (figs. 4 and 4a).

During the following weeks these small fibers became more numerous and penetrated to the center of the graft. The number of fibers in single nerves increased and, about 12 weeks after operation, nerves could be found in the midstroma which contained 5 to 10 fibers (fig. 5). At about the same time, small fibrils could be seen in the

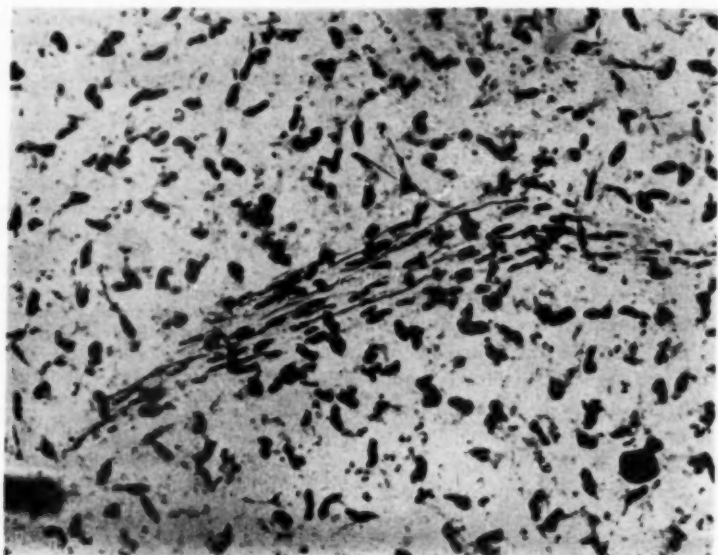


Fig. 2 (Kornbluth, Maumenee, and Crowell). Section of homogenous corneal graft (3 days after operation) showing a degenerating nerve. (Silver impregnation  $\times 125$ .)

By the end of the second week practically all of the nerves had disappeared from the graft. In the recipient's cornea most of the nerve fibers for a distance of about 2 mm. from the incision disappeared and nerves in the periphery showed signs of ascending degeneration.

By 3 weeks newly formed fibers approached the scar on the edge of the graft. These frequently turned back into the recipient cornea or turned and ran parallel to the scar (fig. 3). By 4 to 6 weeks single nerve fibers could be found in the midstroma,

subepithelial and epithelial region in the grafts (figs. 6 and 6a).

During the first two months after operation the nerves in the recipient's cornea at the edge of the graft were usually composed of 1 or 2 fibers but, after 3 to 6 months, nerves containing 6 or more fibers reached the scar tissue surrounding the graft (fig. 7).

#### COMMENT

In this study the return of clinical sensibility coincided well with the anatomic findings. One month after operation only the

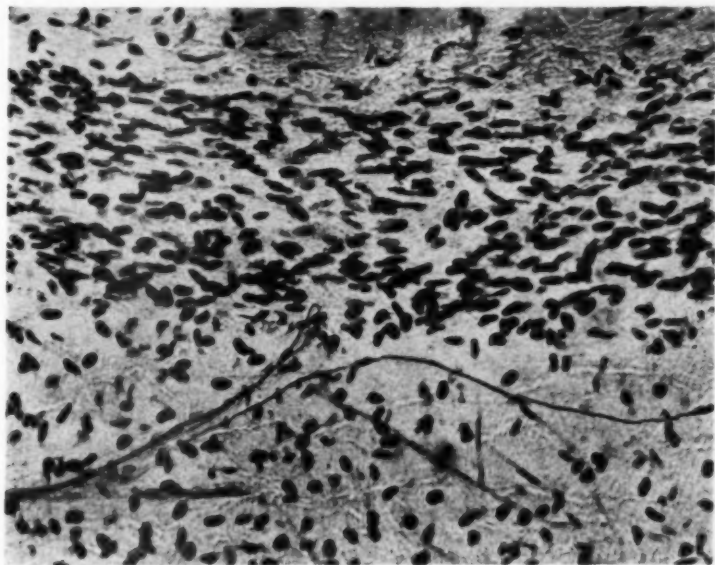


Fig. 3 (Kornblueth, Maumenee, and Crowell). Section of homogenous corneal graft (20 days after operation) showing newly formed nerve fibers in the recipient's cornea approaching the scar on the edge of the graft. (Silver impregnation  $\times 125$ .)

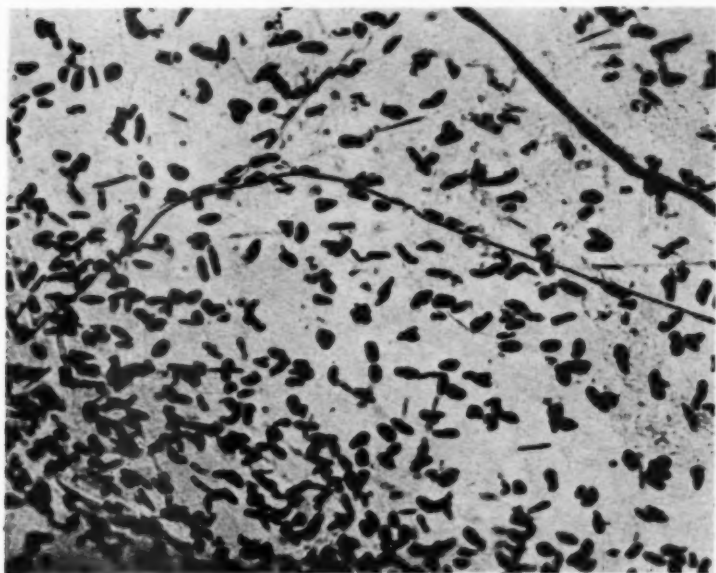


Fig. 4 (Kornblueth, Maumenee, and Crowell). Section of clear homogenous corneal graft (1 month after operation) showing a nerve fiber entering the margin of the graft. Scar at junction of graft and recipient cornea is seen at the lower left. (Silver impregnation  $\times 125$ .)



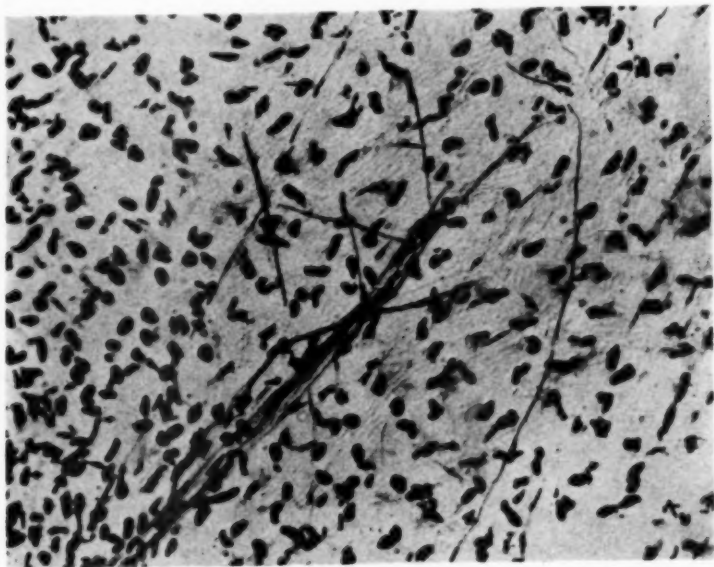


Fig. 4a (Kornbluth, Maumenee, and Crowell). Section of cloudy homogenous corneal graft (6 weeks after operation) showing nerve fibers entering the margin of the graft. Scar at junction of graft and recipient cornea is seen at the lower left. (Silver impregnation  $\times 125$ .)

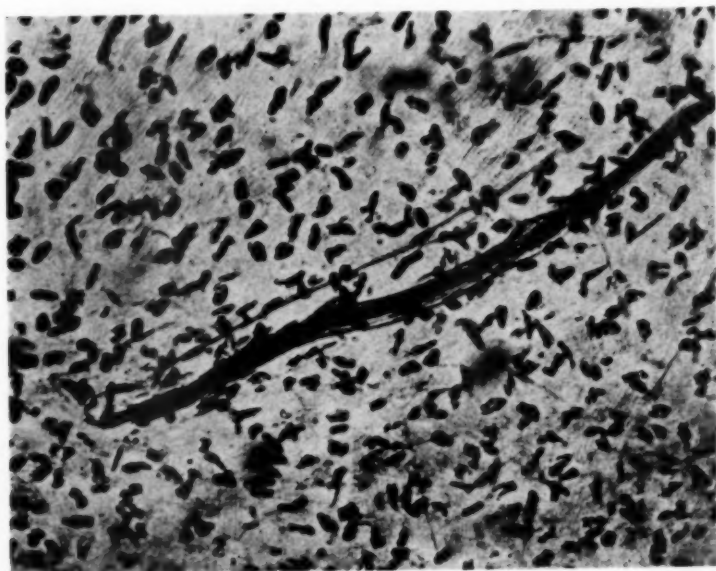


Fig. 5 (Kornbluth, Maumenee, and Crowell). Section of homogenous corneal graft (3 months after operation) showing a thick nerve in the midstroma of the graft. (Silver impregnation  $\times 125$ .)



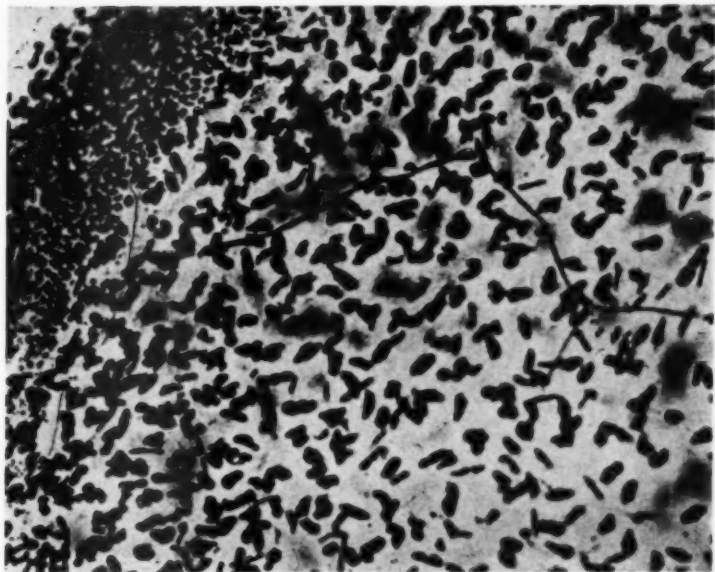


Fig. 6 (Kornblueth, Maumenee, and Crowell). Section of clear homogenous corneal graft (7 months after operation) showing a small nerve fiber entering the epithelium of the graft. Epithelium is at the upper left. (Silver impregnation  $\times 125$ .)



Fig. 6a (Kornblueth, Maumenee, Crowell). Section of cloudy homogenous corneal graft (3 months after operation) showing a small nerve fiber entering the epithelium of the graft. Epithelium is at the upper left. (Silver impregnation  $\times 400$ .)



Fig. 7 (Kornbluth, Maumenee, and Crowell). Section of homogenous corneal graft (7 months after operation) showing a thick nerve in the recipient's cornea entering the scar tissue at the edge of the graft. (Silver impregnation  $\times 125$ .)

margins of the grafts were sensitive to heavy touch (300-mg. test object). During the course of the next few weeks sensitivity to heavy pressure was acquired by the whole graft. This corresponded to the time when only single nerve fibers were found in the midstroma of the transplants. After 3 to 4 months, corneal sensitivity to light touch (100-mg. test object) could be perceived.

At this time, on histologic sections, numerous nerves and nerves with multiple fibers were observed in the midstroma of the graft, and small nerve fibers were found in the subepithelial and epithelial regions. The ingrowth of nerves and return of corneal sensibility was approximately the same in clear and cloudy grafts.

There was no correlation between the invasion of blood vessels and nerves into the graft as had been suggested by Thomas, Babel and Campos, and Franceschetti and Babel. Blood vessels could be found in cloudy grafts 1 to 2 weeks before the nerves entered the graft, and even then the nerves

did not necessarily take the same course as the invading capillaries. On the other hand, nerves were found in entirely clear grafts which did not contain blood vessels.

We were also not able to confirm Franceschetti and Babel's suggestion that the presence of subepithelial nerves in grafts was essential for the final clarity of transplants. In our experiments both clear and cloudy grafts showed thin nerve fibers entering the subepithelial and epithelial region several months after operation (figs. 6 and 6a).

#### SUMMARY

The return of corneal sensitivity was tested in 12 clear and 10 cloudy transplants. The ingrowth of corneal nerves was studied histologically by the use of the silver-impregnation technique in 17 clear and 13 cloudy grafts. The return of deep sensibility in the grafts in 4 to 6 weeks corresponded to the ingrowth of nerves into the midstroma. The acquisition of light sensibility in 3 to 4 months corresponded to the

penetration of nerves into the subepithelial and epithelial regions of the grafts. No appreciable difference was found in the regeneration of nerves into clear or cloudy grafts. The ingrowth of nerve fibers was

not dependent on the invasion of the grafts by blood vessels.

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#### REFERENCES

1. Maumenee, A. E., and Kornblueth, W.: The physiopathology of corneal grafts. *Tr. Am. Acad. Ophth.*, 1948 (Mar.-Apr.), p. 331; *Am. J. Ophth.*, **31**:1384, 1948.
2. Ascher, K. W.: The question of keratoplasty II. *Arch. f. Ophth.*, **107**:241, 1922; The question of keratoplasty III. *Arch. f. Ophth.*, **107**:439, 1922.
3. Elschmig, A.: Keratoplasty. *Arch. Ophth.*, **4**:165, 1930.
4. Imre, J.: Clinical and histological experiences with corneal transplantation. *Beiheft, Klin. Monatsbl. f. Augenh.*, p. 1, 1942.
5. Morone, G.: Research on the sensibility of transplants. *Ann. d. Ottal. e. Clin. Ocul.*, **72**:279, 1946.
6. Thomas, J. W. T.: On the return of sensitiveness in corneal grafts in rabbits. *Proc. Roy. Soc. Med., Series B.*, **108**:301, 1931.
7. Galante, E.: Experimental research on keratoplasty. *Ann. d. Ottal. e. Clin. Ocul.*, **62**:119, 1934.
8. Babel, J., and Campos, R.: On the regeneration of nerves in corneal transplants. *Ophthalmologica*, **111**:140, 1946.
9. Franceschetti, A., and Babel, J.: Histologic examination of a transparent corneal transplant: the behavior of nerves. *Ann. d'Ocul.*, **180**:145, 1947.
10. Jent, M.: The cornea test for the examination at pursuit of regeneration in the peripheral nerves. *Helvet. physiol. acta.*, **3**:65, 1945.
11. Campos, R.: Modification of the method of silver impregnation of Bielschowsky-Gros. *Acta anat.*, **2**:75, 1946.

### A CASE OF SENSITIVITY TO GOLD-BALL ORBITAL IMPLANT\*

#### ECZEMATOUS CONTACT-TYPE DERMATITIS DUE TO 14-KARAT GOLD

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The medical literature contains numerous references to dermatitis following parenteral administration of gold compounds in the therapy of arthritis, lupus erythematosus, vitiligo, and so forth. Ophthalmologists and dermatologists frequently see contact dermatitis due to monel metal (an alloy of copper and nickel) and "white gold" (an alloy of gold, copper, and nickel), which are used extensively in spectacle frames<sup>1</sup> and jewelry. The offending allergen in these cases is considered to be nickel or its salts.

The important synergistic action between pyrogen and nickel allergy has been emphasized by Cormia,<sup>2</sup> Stokes,<sup>3</sup> and others. Gold chloride is said to cause dermatitis among

photographers,<sup>4</sup> but our review of the literature failed to find any report of contact dermatitis due to gold leaf.

Gold, silver, tin, and copper in pure metallic form are not considered primary irritants or sensitizers. Most reports of sensitivity to these metals from their use in industry or in daily life emphasize the fact that usually the offending allergen is a salt of the metal concerned.

The subject of this case report showed a marked sensitivity clinically and by patch tests to a 14-karat gold ball which, 5 years previously, had been implanted into Tenon's capsule at the time of enucleation of the left eye. This sensitivity was manifested by a recurrent seropurulent orbital discharge and an eczematous contact-type dermatitis of the lids and adjacent skin.

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## CASE HISTORY

S. B., a 29-year-old woman, was admitted to the eye ward of the Hospital of the University of Pennsylvania on May 11, 1939. The ophthalmic history dated back to the age of six years when she started school and was found to have subnormal vision in each eye uncorrectible by glasses. She had had numerous operations on both eyes elsewhere. On admission here, the visual acuity of the right eye was hand movements; of the left eye, no light perception. The diagnosis was bilateral congenital dislocated lenses with uveitis and secondary glaucoma. The left eye was blind and painful. Enucleation was performed and a 14-karat gold ball, 14 mm. in diameter, of the standard variety used at that time, was implanted into Tenon's capsule. Recovery was uneventful. A glass prosthetic shell was procured.

She was next seen in the eye dispensary on April 23, 1942, at which time the left orbit was clean and well healed without any signs of irritation.

On September 9, 1944, 5 years after implantation of the gold ball, a purulent discharge from the left orbit developed. This failed to improve under treatment with 5-percent sodium sulfathiazole solution and the lids became excoriated. A culture made in November, 1944, showed hemolytic *Staphylococcus aureus* and diphtheroids. Medication was stopped because of possible sulfathiazole sensitivity, and the patient was advised to discontinue wearing her glass prosthesis. The only treatment permitted was boric-acid irrigations for removal of secretions from the socket. No improvement resulted, and a patch test on the skin for sulfathiazole sensitivity was negative.

In January, 1945, four months after the development of the orbital discharge, penicillin drops and ointment were tried with sulfadiazine systemically. The treatment, administered in the ward, rapidly cleared up the cellulitis of the lids, but the discharge

from the orbit continued for another week and then stopped. The patient was again able to wear her glass prosthesis.

When the discharge recurred three weeks later, dermatologic consultation was obtained. At that time the patient presented an erythematous, oozing, vesiculopapular dermatitis of left eyelids and adjoining malar region. The diagnosis was acute recurrent infectious eczematoid dermatitis secondary to the seropurulent discharge from the left orbit. There was considered to be an associated eczematous contact-type dermatitis due to sensitivity to locally applied medicaments. The question of sensitivity to the glass prosthesis was again raised. Use of the prosthesis was discontinued, and potassium permanganate injections were tried. Four days thereafter the orbit appeared clean, but the lids were still inflamed.

In April, 1946, the patient was readmitted to the ward because of continued orbital discharge and edema of the lids. She was thoroughly studied from the standpoint of allergy and focal infection, including the lacrimal sac. The positive findings included marked skin sensitivity to a 1:100 dilution of Squibb's *Staphylococcus ambotoxoid*, and a culture of the orbital discharge showed hemolytic *Staphylococcus aureus*.

Patch tests to numerous cosmetics and locally applied medicaments showed positive reactions only to penicillin and sulfathiazole. She had previously shown no skin sensitivity to sulfathiazole. Because the lid excoriation and discharge cleared up and recurred many times in a most annoying and inexplicable manner, malingering was suspected. During this period of hospitalization the patient was closely observed for evidence of self-inflicted excoriations. This could not be proved.

A course of desensitization with *Staphylococcus ambotoxoid* was given from May, 1946, to February, 1947. The discharge im-

proved and relapsed frequently, and in October, 1946, tyrothricin 0.5 mg./cc. locally was started. This was followed by improvement for two weeks and then a relapse. X-ray studies of the nasolacrimal apparatus filled with Beck's paste showed no obstruction, and repeated culture of the discharge showed again hemolytic *Staphylococcus aureus* and diphtheroids.

Flare-ups alternated with remissions approximately every two weeks, and in February, 1947, the patient received two treat-

next remission, she was admitted to the eye ward for the fourth time.

It was determined that 14-karat gold is composed of 60-percent fine gold, 35-percent copper, 5-percent silver and tin. Standard, closed patch tests to the following metals and their salts were performed (table 1). All positive tests increased in severity for 24 to 48 hours following removal of test substance.

Skin sensitivity to the gold salt, gold leaf, and 14-karat gold ball was most marked

TABLE 1  
REACTION TO PATCH TESTS OF METALS AND THEIR SALTS

Material Tested	Site of Testing	Reaction*
Copper sulphate (1% solution)	Forearm, volar aspect	1 plus
Gold sodium thiosulphate (0.5% aq. sol.)	(Forearm, volar aspect	1 plus
	Upper chest	2 plus
	Upper back	2 plus
	Forehead	4 plus
	(removed after 4 hrs.)	
Pure silver leaf	Forearm, volar aspect	0
Pure tin leaf	Forearm, volar aspect	0
Pure copper leaf	Forearm, volar aspect	0
Pure gold leaf	Forearm, volar aspect	2 plus
14-karat gold ball	(Forearm, volar aspect	1 plus
	Upper arm	2 plus
	Right side of forehead	4 plus
	(removed after 10 hrs.)	
Plastic ball	Left side of forehead	0

\* Reactions were graded as follows (after Bloch):

1 plus = erythema.

2 plus = erythema and edema and/or beginning papulation or vesiculation.

3 plus = fully developed vesiculation, papulation, edema, bullae.

4 plus = strongest reaction—denudation, necrosis, and so forth.

ments with intermediate X ray after which there was again marked improvement for three weeks.

The patient had been seen repeatedly in the staff conferences of the ophthalmology and dermatology departments and finally the possibility of allergy to the gold-ball implant as an etiologic factor was considered. Such an allergy has never been reported in the literature to our knowledge. However, the situation was becoming desperate from the standpoint of the psychiatric status of the patient. Accordingly, during the

on the forehead; that is, the site nearest the patient's orbital implant. Removal of this implant was done on April 9, 1947. A plastic ball implant was substituted into Tenon's capsule. The patient had previously been patch-test negative to this plastic ball.

Five days later, there was practically no operative reaction. Because of the uniqueness of this case, and also because of the incredulity with which a gold-ball sensitivity was viewed, the patient was skin tested with the gold ball removed at the time of the operation. This gold ball was placed on the

left forearm in light contact with the skin, being held in place with a dry gauze dressing. Twelve hours later the gold ball had to be removed because of marked erythema, edema, and vesiculation at the site of the skin test; there was associated urticaria over both arms, face, neck, chest, and back.

Three days later, after this reaction subsided, the gold ball was placed on the right forearm and in 12 hours the same systemic reaction was produced, involving in addition the skin of the legs. There was a marked eczematoid reaction over a 10 by 15-cm. area at the gold-ball test site. The reaction again subsided in 3 days. This second test was performed because it seemed most unusual that the patient should manifest what was apparently an epidermal and generalized dermal sensitivity to supposedly inert 14-karat gold.

The patient was discharged to the eye clinic. All treatment was stopped and a new plastic prosthesis was obtained. One week after removal of the gold ball she was comfortable and without any abnormal secretion from the left orbit. At 2 weeks she still had no discharge. At 6 months and 8 months the orbit was completely normal, and according to the patient had given her no trouble. She was delighted with the result. At the time of this report two years have elapsed since removal of the gold ball and the patient has had no recurrence of her disfiguring orbital discharge which for 3 years prior to removal of the gold ball had made her life miserable.

#### COMMENT

Since contact sensitivity to metallic gold was not known to occur, and because the gold ball contained in Tenon's capsule was not in direct contact with conjunctiva or skin, the true diagnosis was not suspected

until 3 years after the onset of symptoms.

It is not known why the patient did not develop generalized allergic symptoms, such as were manifested on subsequent patch testing, but instead showed sensitivity only of the conjunctiva, eyelids, and adjacent skin. The tip-off to the correct diagnosis resulted from a consideration that one or more of the metals in the 14-karat gold ball might be acting in a manner analogous to the well-known synergistic nickel-pyogen allergy.

Throughout the entire course of this patient's symptoms, repeated cultures showed pathogenic hemolytic staphylococci, coagulase positive, to which the patient was markedly sensitive by intradermal testing.

The patch-test reactions to the gold ball, 0.5-percent gold sodium thiosulphate, and gold leaf, not only showed marked erythema, edema, and vesiculation but also small pustules at the test sites. This reaction is similar to the patch-test reactions with proper strength solutions of nickel salts.

It is important to note that this patient apparently manifested not only marked local epidermal sensitivity when patch tested with the gold ball removed from her orbit, but also showed seemingly generalized dermal sensitivity in the form of pruritus and urticaria.

#### SUMMARY

1. A case is reported showing clinical sensitivity to a 14-karat gold orbital implant.
2. Patch tests to the 14-karat gold ball and to pure gold leaf were strongly positive; whereas, similar patch tests with other metallic components of 14-karat gold were negative.
3. Importance of synergistic metal-pyogen allergy is emphasized.

#### REFERENCES

1. Taylor, W. O. G., Gerguson, A. G., and Atkins, W. R. G.: *Brit. Med. J.*, 2:40 (July) 1945.
2. Cormia, F. E., and Stewart, S. G.: *Canadian M.A.J.*, 98:524, 1932.
3. Stokes, J. H., Lee, W. E., and Johnson, H. N.: *J.A.M.A.*, 123:195 (Sept.) 1943.
4. Schwartz, Tulipan, and Peck: *Occupational Diseases of the Skin*. Philadelphia, Lea, 1947.



## HEPARINIZATION OF THE EYE\*

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This study was undertaken to investigate the use of heparin as a means of reducing postoperative scarring. Fibroblastic proliferation is a frequent cause of failure in glaucoma operations. There is good experimental and theoretical evidence to indicate that heparin might produce such a desired result by virtue of its growth-retarding characteristics, as well as its fibrin-inhibiting effect.

Goerner<sup>1</sup> demonstrated that heparin inhibited the growth in tissue culture of the Flexner-Jobling rat sarcoma. Fischer and Parker,<sup>2</sup> and later Zakrewski<sup>3</sup> demonstrated that proliferation of normal tissue fibroblasts in culture was depressed and differentiation enhanced by the use of heparin. Zakrewski thought that an antagonism existed between prothrombin and heparin. Prothrombin favored proliferation and growth, while heparin caused differentiation. Guy,<sup>4</sup> in the tissue-culture laboratory at The Johns Hopkins Hospital, observed that tissue growing in a heparinized media fails to grow in tissue sheets, that the normal bridging material between cells is not laid down, and that individual cells separate easily. Heparin is also known to inhibit the growth of yeast.<sup>5</sup>

Widstrom and Wilander,<sup>6</sup> in 1936, demonstrated that experimental pleurisy in rabbits could be modified by local heparinization, rendering exudate so incoagulable that it all was absorbed and no residual of the pleuritic process could be observed. Control animals developed dense pleural adhesions. In 1940, Lehman and Boys<sup>7</sup> reported on the intraperitoneal injection of heparin in rabbits and dogs to prevent the adhesions of exper-

imental peritonitis. They were able to eliminate the reformation of adhesions in a large percentage of cases.

Laufman and Heller,<sup>8</sup> in 1942, tested the strength of abdominal wounds in systemically heparinized dogs. Up to the 5th day, there was delayed union, weakness of the wound, and less fibrin than in the controls. Even with poorly controlled heparinization, they were able to prevent healing until the 5th day.

### CHARACTERISTICS OF HEPARIN

Heparin is a nontoxic polysaccharide and is present in connective tissue in association

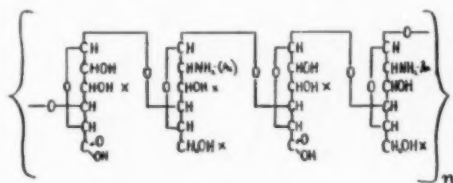


Fig. 1 (Bick). Formula for heparin as proposed by Charles and Todd.

with the metachromatic staining granules of the mast cells of Erlich. These cells give the same reaction with toluidine blue as heparin.<sup>9</sup> The heparin content of a tissue is proportional to the number of mast cells found therein. Commercially, heparin is obtained from ox lung, 100 gm. of which yield 1 gm. of heparin. The chemical formula suggested by Charles and Todd is given in Figure 1, which represents a carbohydrate complex having a configuration of two hexuronic molecules and two hexosamine.<sup>10</sup> The amino groups are acetylated, and the hydroxyl groups indicated by x are thought to be sulfated. Heparin is the strongest known organic acid found in the body. It combines with protein and especially with protamine, which inactivates the anticoagulant activity.<sup>11</sup>

\*From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital and University. This study was supported in part by the Chalfont Fund. The heparin used in this work has been generously donated by the Abbott Research Laboratories, North Chicago, Illinois.

Heparin readily forms stable salts with protein.

Heparin has a strong electronegative charge and shifts the isoelectric point of protein in neutral solution to the acid side. Precipitated protein can be peptized by adding heparin.<sup>12</sup> Thus, at pH 5 casein is insoluble, but heparin casein is soluble at this hydrogen-ion concentration.

Heparin is freely soluble in aqueous media. When used intravenously, it has no effect on the sugar, calcium, uric-acid, non-

blood stream, the intestinal tract is the only tissue where the heparin content increases. The rapid disappearance of heparin from the blood stream is postulated to be due to an enzyme, heparinase.<sup>13</sup> Recent evidence indicates that a very small portion of heparin is excreted in the urine.<sup>14</sup>

Heparin has no effect on the capillary permeability in inflammation, the localization of leukocytes at an inflammatory site, or the phagocytosis of staphylococci by polymorphonuclear leukocytes.<sup>15</sup> It has no effect on

TABLE 1  
THE EFFECT OF INTRAVENOUS HEPARIN ON THE COAGULATION  
TIME OF THE ALBINO RABBIT

Dose*	C.T.† (Min.)	Blood Coagulation Time (B.C.T.)							
		At ½ Hr.	At 1 Hr.	At 2 Hr.	At 3 Hr.	At 4 Hr.	At 5 Hr.	At 5.5 Hr.	At 12 Hr.
		(Min.) 8	(Min.) 10	(Min.) 2	(Min.)	(Min.)	(Min.)	(Min.)	(Min.)
0.5	2.5								
1.0	3.0	10	12	2					
2.0	2.0	30	15	2					
4.0	2.5	120	—	55	5	2			
5.0	2-3	Inf.‡	—	—	—	4.5	2		
10.0	2-3	Inf.	—	—	—	4.0	2		
15.0	2-3	Inf.	—	—	—	55	3.5	2	
20.0	3.5	Inf.	—	—	—	30	3.5	—	
25.0	2-3	Inf.	—	—	—	35	12	10	2

\* Dose given as milligram per kilogram.

† C.T. is clotting time.

‡ Inf. is infinity.

protein-nitrogen, phosphatase, red-cell, white-cell, and hematocrit determinations. It has no effect on the body temperature or blood pressure. Also, it is nonantigenic and can be used repeatedly.<sup>9</sup>

Heparin appears to be the normal anticoagulant of the blood. There is evidence to indicate that heparin acts as an antiprotease as well as an antithrombin. It counteracts the effect of thrombokinase which normally converts prothrombin to thrombin. When heparin is injected into the

the phagocytosis of foreign particulate matter by the reticulo-endothelial system.<sup>16</sup>

A Howell unit is that amount of heparin which maintains 1.0 cc. of cat's blood fluid in the cold for 24 hours. A heparin unit or Toronto unit is equal in activity to 0.01 mg. of crystalline barium salt. This is approximately equal to 5 Howell units. One mg. of commercially pure heparin salt is equal to 100 Toronto or 500 Howell units.<sup>9</sup>

Before the local potentialities of heparin could be studied, it was necessary to deter-

mine the most efficient method of heparinizing the eye. The simplest means of following the concentration of heparin is by observations on the blood coagulation time. By knowing the effect and utilization of a given intravenous dose, one can compare its anticoagulant properties with that of a similar amount of heparin introduced into other tissues. In this manner, one can obtain indirect evidence as to the concentration of heparin in the tissues. This method proved to be of value in exploring the manner in which heparin enters and leaves the eye.

#### UTILIZATION OF INTRAVENOUS HEPARIN

A series of experiments were undertaken to determine what effect a given intravenous dose has on the B.C.T. (blood coagulation time) of the rabbit.

Albino rabbits were used in this and in all subsequent experiments. Nembutal anesthesia was injected into the ear vein 5 minutes prior to the injection of heparin. The dosage of anesthesia was 300 mg. per kg. of body weight which corresponds to 0.5 cc. in our preparation. The dosage of nembutal was calculated accurately because barbiturates are known to increase the effectiveness of heparin. For convenience, a commercially available sodium heparin preparation containing 10 mg. of sodium salt per cc. was employed and was injected into the ear vein.

The B.C.T. was determined one-half hour after the heparin injection and as often as necessary thereafter to obtain a curve.

The clotting time was determined by the capillary tube method<sup>17</sup> run in duplicate to check each determination. A new Bard-Parker blade was used to sever an ear vessel transilluminated by a small electric bulb. Freely flowing blood was permitted to run into two capillary tubes. A stop watch was started and the tubes were broken at regular intervals. The observation of a fine coagulated elastic thread stretching between the broken ends of capillary tubing was regarded as the end point. This end point was checked

by breaking the second tube. If clotting had not occurred two hours after the blood had been drawn, it was regarded as incoagulable. The results of these experiments are summarized in Table 1 and are plotted in Figure 2.

It is concluded from this data that, within

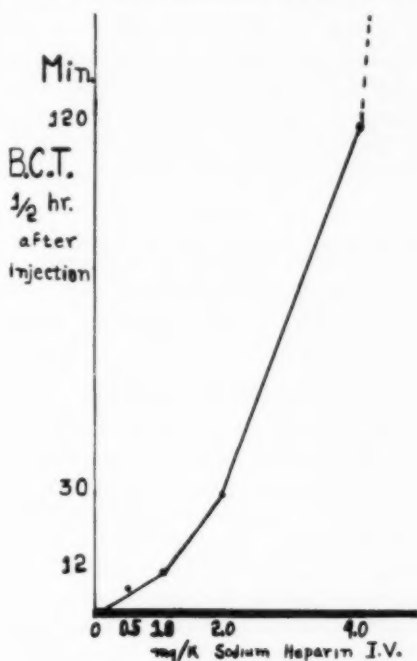


Fig. 2 (Bick). The effect on the blood coagulation time of an intravenous dose of heparin. Determinations were made one-half hour after administration.

a critical range of dosage of from 1 to 4 mg. per kg., there is a rapidly progressive increase in the effect on the clotting time. Above 4 mg. per kg. of body weight this relationship is not maintained and the blood becomes incoagulable. Above 4 mg. per kg., heparin acts like a threshold substance inasmuch as any dosage over this affects the coagulation time in the same way, and for the same length of time. In general, it may be concluded that a single intravenous dose in the rabbit producing a safe clotting time

cannot exceed 4 mg. per kg., and such an effect lasts only 3 hours. Even for dosages that render the blood incoagulable, it is impossible to produce elevated clotting time over 4 or 5 hours with a single intravenous dose.

#### HEPARIN CONCENTRATION AND COAGULATION TIME

The second experiment was performed to determine the relationship between the quantity of heparin present in the blood and the coagulation time such a level produces. There is no difference in the potency of

TABLE 2

RELATIONSHIP BETWEEN HEPARIN CONCENTRATION AND COAGULATION TIME OF RECALCIFIED RABBIT BLOOD

Solution Tested	B.C.T. (min.)	mg. Heparin per cc. Blood
0.1 mg. Sodium Heparin	Inf.*	0.5
0.01	30	0.05
0.001	18	0.005
0.0005	12	0.0025
0.0001	4	0.0005
0.00001	3.25	0.00005
0.000001	4.00	0.000005
Saline	3.50	0.0
Blank	4.00	0.0

\* Inf. is infinity.

heparin in vivo and in vitro.<sup>18</sup> The concentration of blood heparin necessary to establish a given coagulation time is readily determined in vitro.

If known quantities of heparin are added to blood and the coagulation time determined, one can obtain a series of values by which the quantity of heparin present in the blood can be determined by observing the clotting time.

For convenience, blood which has been rendered incoagulable by decalcification with oxalate is employed. A known amount of heparin is added to the blood and the blood is recalcified. The recalcified clotting time is determined, and any elevation over the normal controls is attributed to the presence of heparin.

Rabbit's blood drawn from the heart of two rabbits and pooled was used for this experiment.

The determination was carried out as follows. One cc. of 1 molar sodium oxalate and 9 cc. of heart's blood from one rabbit were mixed thoroughly. This was pooled with a specimen of blood similarly prepared from a second rabbit.

One tenth cc. normal saline containing heparin was mixed with 0.2 cc. of oxalated rabbit blood on a clean watch glass. Twenty-five thousandths of a cc. of 1 molar calcium chloride was placed alongside the blood on the watch glass and mixed thoroughly with a clean glass rod for 2 seconds. A stop watch was started and the watch glass was gently rocked every 15 to 30 seconds until the blood was completely clotted. Clotting was considered complete when the watch glass was placed at a 90-degree angle to the table without fluid running off. Each specimen was run in duplicate and checked within 30 seconds of each other. The average reading for each dilution of heparin is reported in Table 2.

While decalcification and recalcification are described as increasing the speed of clotting<sup>19</sup> by the release of thromboplastin, no appreciable decrease in clotting time was observed in this experiment.

This study indicates that dilution of the blood by the test solution in itself has no effect on the clotting time. The clotting time of the controls was between 3.5 and 4.0 minutes. One half of a microgram of heparin per cc. of rabbit's blood had no effect on the clotting time; whereas 2.5 micrograms delayed clotting for 12 minutes. Within a range of concentration there appears to be a logarithmic relationship between clotting time and the heparin concentration (fig. 3). By knowing the clotting time of rabbit's blood in this range, one can calculate the concentration of circulating heparin. For example, if the clotting time of an animal were 30 minutes, the heparin

concentration would be approximately 50 micrograms per cc. The validity of this figure can be tested as follows.

Rabbit H-27 weighing 2.4 kilograms was given an intravenous dose of 2 mg. per kg. and the B.C.T., 15 minutes later, was found to be 30 minutes. Approximately 10 percent of the body weight is due to blood.<sup>20</sup> Therefore, 4.8 mg. was distributed in about 240 cc. of blood or 20 micrograms per cc. These figures of heparin concentration in vitro and

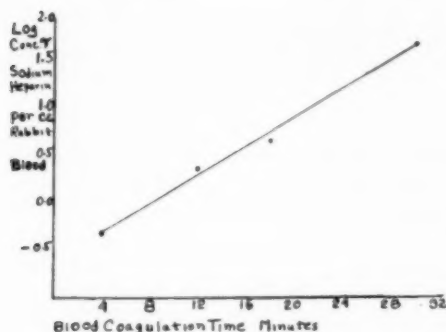


Fig. 3 (Bick). Each point plotted represents two determinations which checked within 30 seconds.

the estimated blood concentration are of the same order of magnitude.

#### HEPARIN AND THE AQUEOUS

The next problem was to determine if heparin enters the intraocular fluids.

The quantity of anticoagulant in a fluid can be determined by the technique described in the previous experiment; that is, known quantities of heparin were added to decalcified rabbit blood and the various unknowns were set up in the same way. On recalcification, the clotting time was determined.

Three rabbits were used receiving the dose indicated in Table 3. The intravenous dose was given under nembutal, the aqueous was removed from both eyes one-half hour after injection of heparin, and B.C.T. of the rabbit was determined simultaneously.

Within the sensitivity of this experiment,

TABLE 3  
ANTICOAGULANT EFFECT OF PRIMARY AQUEOUS FOLLOWING INTRAVENOUS HEPARIN

	Dose Sodium Heparin	B.C.T. (min.)	Aqueous+ Blood C.T.* (min.)
Rabbit	0.5 mg./kg.	8	R.E. 4.0 L.E. 4.5
Rabbit	2.0 mg./kg.	30	R.E. 4.5 L.E. 3.5
Rabbit	3.0 mg./kg.	120	R.E. 4.0 L.E. 4.5
Standard	0.5 Gamma		12
	0.1 Gamma		4
Control			4

\* C.T. is clotting time.

which was 5 gamma of heparin per cc. of aqueous, no heparin was found in the primary aqueous.

It was found that the sensitivity of the method could be increased by using freshly shed human blood collected and stored in silicon-treated glassware. Silicon is a plastic material which prevents clotting for about one hour without the addition of anticoagulant. As soon as the blood comes in contact with ordinary glass, clotting begins. Human blood contains less circulating thromboplastin and does not clot as rapidly as rabbit blood. On one occasion, sensitivity to one-one hundredth of a microgram of sodium heparin was obtained.

The method using human blood was as follows. A sterile silicon-coated needle and syringe were used to draw 10 cc. of blood from the antecubital vein, and the blood was then carefully transferred to a silicon-coated test tube. The blood was pipetted into tiny test tubes used for prothrombin time determination in the proportion of 0.2 cc. of blood to 0.1 cc. of solution to be tested. The solution was placed in the tubes before the blood was added and the tubes were agitated for 2 or 3 seconds following the addition of the blood to insure thorough mixing. The stop watch was started the instant the glass

TABLE 4  
ANTICOAGULANT EFFECT OF RABBIT AQUEOUS FOLLOWING INTRAVENOUS HEPARIN

Test Solution	Clotting Time (Minutes)	
Sodium Heparin 0.01 mg./cc.	Inf.*	
Sodium Heparin 0.001 mg./cc.	13	
Sodium Heparin 0.0001 mg./cc.	9	
Sodium Heparin 0.00001 mg./cc.	9	
Saline Control	9.50	
Saline Control	9.50	
Rabbit 1—mg./kg. Primary Aqueous	(R) 8.25	(L) 9.75
Secondary Aqueous	(R) 8.50	(L) 9.25
Tertiary Aqueous	(R) 8.50	(L) 10.25
Rabbit 3—mg./kg. Primary Aqueous	(R) 8.75	(L) 10.50†
Secondary Aqueous	(R) 13.00	(L) 11.75
Tertiary Aqueous	(R) 11.75	(L) 10.75

\* Inf. is infinity.

† Bloody tap.

pipette came in contact with the blood in the silicon coated test tube. All transfers were completed within a minute after the initial contact with glass. The tubes were partially inverted every 30 seconds until clotting was completed. This was verified by complete inversion of the tube. For each determination, standards of known amounts of heparin

were set up with saline controls in duplicate.

The first experiment using the siliconed human-blood technique described above was to determine the concentration of sodium heparin in the primary, secondary, and tertiary aqueous with moderately small doses of intravenous heparin. Two albino rabbits anesthetized with nembutal (300 mg. per kilogram) were given heparin in the ear vein. Aqueous was withdrawn with a hypodermic needle on a tuberculin syringe 15 minutes, 30 minutes, and 45 minutes following the injection. About 0.25 cc. of primary aqueous could be withdrawn, and 0.2 cc. of secondary and tertiary aqueous was obtained. Care was exerted not to damage the iris vessels with the point of the needle. An oblique puncture through the cornea was found to be important to prevent the escape of aqueous around the needle and the subsequent leaking of aqueous after withdrawal of the needle. The results of this experiment are summarized in Table 4.

Using higher concentrations of heparin, the experiment was repeated (Table 5). It is concluded that the primary aqueous contains no heparin. When the blood-aqueous barrier is disturbed by paracentesis, heparin enters the aqueous in concentrations proportional to the blood level.

TABLE 5  
ANTICOAGULANT EFFECT OF RABBIT AQUEOUS  
FOLLOWING INTRAVENOUS HEPARIN

Test Solution	Clotting Time (Minutes)
Sodium Heparin	
0.01 mg.	Inf.†
0.001 mg.	22
0.0001 mg.	13
0.00001 mg.	11.5
0.000001 mg.	8.5
Rabbit 10—mg./kg.	
Primary Aqueous (30)*	6.5
Secondary Aqueous (45)	14.5
Tertiary Aqueous (55)	37.0
Rabbit 20—mg./kg.	
Primary Aqueous (30)	5.0
Secondary Aqueous (45)	42.0
Tertiary Aqueous (55)	27.0
Saline Control	6.25
Saline Control	7.00

\* Parenthesis figure indicates number of minutes after heparin was administered intravenously.

† Inf. is infinity.



## REMOVAL OF HEPARIN FROM THE AQUEOUS

If heparin is placed in the anterior chamber by paracentesis, one inadvertently disturbs the blood-aqueous barrier, but since heparin is not present without such a disturbance, a study of its removal under such circumstances is desirable. To follow the removal indirectly by observing the clotting time of the animal, is a simple method when one knows the effects of a similar intravenous dose.

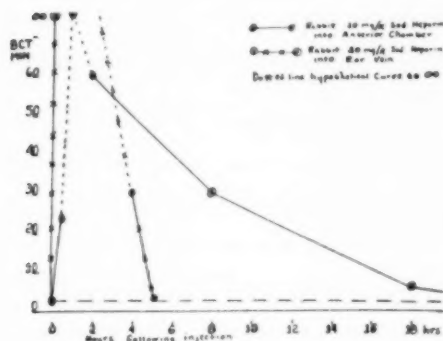


Fig. 4 (Bick). Comparison of the anticoagulant effect of heparin given intravenously with that administered by an anterior-chamber injection.

Sixty mg. of sodium heparin were taken up in 0.2 cc. of physiologic saline. The primary aqueous of an albino rabbit, weighing 2.9 kg. and anesthetized with sodium pentobarbital, was allowed to drain off through a hypodermic needle. The heparin dose was divided between the two eyes. The results of this experiment are summarized in Figure 4.

Ordinarily, in 5 hours, such a dose given intravenously would be entirely disposed of. At the end of the 18 hours following injection into the anterior chamber, there was still some elevation of the clotting time.

Intravenously, such a dose produces an immediate rise in the coagulation time to infinity. It takes approximately an hour for the blood to become incoagulable when the same quantity of heparin is put into the

anterior chamber. This indicates that heparin meets some resistance to its arrival in the blood stream. This resistance accounts also for the elevation of the coagulation time for almost 24 hours. Some free heparin must, therefore, remain in the aqueous for this length of time.

## CONCLUSIONS

In order to heparinize an eye effectively, one must either break down the blood aqueous barrier, or one must place the heparin directly into the eye. Even a concentration of heparin which renders the blood incoagulable will not produce heparinization of the intraocular fluids until something is done to disturb the capillary permeability. The concentration of anticoagulant in this secondary aqueous, as may be expected, is proportional to the level of heparin in the blood.

When heparin is placed inside the eye on the aqueous side of the barrier, there is a delayed anticoagulant effect on the blood as compared with a similar intravenous dose. This slowness of absorption into the blood indicates resistance to the passage of heparin out of the aqueous.

Unless a continuously high blood level of heparin is maintained, and the capillary permeability is continuously increased, heparinization of the eye by the parenteral route would be impossible. Although one might produce a continuously high blood level by divided dosage or using various heparin binders, or Pitkin's menstruum, it would be difficult to guarantee a high capillary permeability except for a short period of time.

Therefore, the most practical means of heparinizing the eye is by introducing the heparin directly.

## SUMMARY

A brief review of the pertinent facts regarding heparin are given. The relationship between dosage, blood concentration, and coagulation in the rabbit was studied. The

manner in which heparin enters and leaves the intraocular fluid was investigated. It is concluded that the most practical and certain method of heparinizing the eye is by the direct introduction of heparin.  
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## REFERENCES

1. Goerner, A.: The influence of anti-clotting agents on transplantation and growth of tumor tissue. *I. Lab. & Clin. Med.*, **16**:369, 1931.
2. Fischer, A., and Parker, R. C.: Dauerzuchtung in vitro ohne wachstumsbeschleunigung. *Arch. f. exper. Zellforsch.*, **8**:325, 1929.
3. Zakrewski, Z.: Die rolle des Prothrombins und Heparins bei der proliferation und differenzierung von gewebe: Untersuchung in vitro. *Arch. f. exper. Zellforsch.*, **13**:152, 1932.
4. Guy: Personal communication.
5. Fischer, A., and Nystrom, P.: Heparin als wachstumhemmender stoff. *Biochem. Ztschr.*, **262**:364, 1933.
6. Widstrom, G., and Wilander, O.: Treatment of experimental pleurisy in rabbits with heparin. *Acta med. Scandinav.*, **88**:434, 1936.
7. Lehman, E. P., and Boys, F.: Heparin in the prevention of peritoneal adhesions. *Ann. Surg.*, **112**:969, 1940.
8. Laufman, H., and Heller, R. E.: *Surg. Gynec. & Obst.*, **76**:655, 1943.
9. D'Allesandro, A. J.: Heparin: Its properties and clinical use. *Internat. Abstr. Surg.*, **74**:62-69, 1942.
10. Charles, A. F., and Todd, A. R.: Observations on structure of the barium salt of heparin. *Biochem. J.*, **34**:112, 1940.
11. Chargoff, E., and Olsen, K. B.: Studies in the chemistry of blood coagulation: Action of heparin and other anti-coagulants. *J. Biol. Chem.*, **112**:153, 1937.
12. Fischer, A.: Die Bindung von Heparin an eiweiss. *Biochem. Ztschr.*, **278**:133, 1935.
13. Jacques, L. B.: Heparinase. *J. Biol. Chem.*, **133**:445, 1940.
14. Astrup, P.: On determinations of heparin in blood plasma and urine. *Acta Pharmacol.*, **3**:165, 1947.
15. Rigdon, R. H., and Wilson, H.: Capillary permeability and inflammation including localization of leukocytes in rabbits given heparin. *Arch. Surg.*, **43**:64-73 (July) 1941.
16. Rigdon, R. H., and Shratz, F. S.: Effect of heparin on phagocytosis by the reticulo-endothelial system. *Ann. Surg.*, **116**:122-126 (July) 1942.
17. Kracke, R. R.: *Diseases of the Blood*. Philadelphia, Lippincott, Ed. 2, 1941, p. 634.
18. Mason, M. F.: Heparin: A review of its history, chemistry, physiology and clinical application. *Surg.*, **5**:451-465, 618-634, 1938.
19. Conley, C. L.: Personal communication.
20. Best, C. H., and Taylor, N. B.: *Physiological Basis of Medical Practice*. Baltimore, Williams & Wilkins, 1945, p. 16.

## OPHTHALMIC MINIATURE

The use of the eye is to identify objects and to protect the body from external dangers, to deal with them as one sees fit. That is the reason it is placed in the uppermost portion of the organ, like a watcher in a garden.

The chief function of the eye is to recognize colors, the shape of objects, the details of bodies, and to determine what is large and what is small.

*Memorandum Book of a Tenth-Century Oculist.*

Translated by Casey A. Wood.

## THE PRESERVATION OF RABBIT CORNEA FOLLOWING EXPOSURE TO THE CAPACITRON\*

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### INTRODUCTION

One of the greatest handicaps to the more universal performance of the corneal transplant operation (circumscribed penetrating keratoplasty) is the unsatisfactory preservation of the donor tissue for prolonged periods. Many methods have been advocated and much has been written about the various techniques for corneal storage. However, the fact remains that with present methods the cornea cannot be preserved as suitable donor material for periods longer than 72 hours. A surgeon must have a close association with an eye bank or he cannot hope to perform this operation in his everyday ophthalmic practice.

What are the ideal conditions for storing the donor cornea? The answer cannot be given absolutely but the accumulated evidence indicates the following:

1. There should be a minimum interference with the physiologic status of the tissue.
2. Bacterial growth must be inhibited.
3. The tissue must retain its proper dimensions (that is, neither shrunken nor swollen) and the cellular architecture particularly of the epithelium and endothelium must not be altered.

Most methods of preservation attain one of these goals at the expense of the others. Thus, freezing and formalin prevent bacterial contamination but they grossly alter the cellular structure and physiologic functions. Storage in low-temperature Ringer's atmosphere permits bacterial contamination

and corneal swelling. Perhaps no method will satisfy all the requirements for ideal storage, but it is apparent that the closer a given method approaches the ideal the more useful it will become for clinical practice.

It was with these factors in mind that we have attempted a new method of corneal preservation and our results are described in this report.

The principle of the Capacitron treatment is based on the bombardment of electrons into fresh tissue targets for ultrashort exposure periods.<sup>1</sup> In the treatment of such tissues as the cornea, the aim is to provide enough exposure time for the electrons to produce a biologic effect but too brief an exposure for the initiation of other and undesirable chemical side reactions. The Capacitron used delivers impulses of accelerated electrons at an energy of 2.2 Mev. at an intensity of 10,000 amperes during an exposure of about  $1 \times 10^{-6}$  seconds. Since this method has shown promise in the preservation of foodstuffs,<sup>1</sup> we hoped that it might preserve corneas also.

### METHODS

Twenty-nine mature colored rabbits (58 eyes) were the source of corneas for these experiments, 9 of which were kept as controls. The animals were killed with intravenous air injections, the eyes were enucleated, and the entire corneas were removed.

A 4-mm. scleral collar was retained on some of the corneal specimens. As Cogan and his associates have demonstrated, the stromal limbus does not possess a protecting semipermeable membrane.<sup>2</sup> Thus we hoped a scleral collar would prevent hydration or dehydration at this portal.

The fresh corneas were immediately placed in ampules and were divided into

\* Capacitron exposures were made in the laboratories of Electronized Chemicals Corporation through the cooperation of A. Brasch and W. Huber.

† This study was supported in part by a grant in aid from The Research Study Club of Los Angeles.

5 groups of 3 ampules each receiving 2, 4, or 6 impulses from the Capacitron. The media in the 5 groups of sealed ampules were: (1) Air; (2) air and 1 cc. of frozen saline (which was permitted to melt after exposure and was stored at room temperature); (3) air and 1 cc. saline (liquid); (4) nitrogen; (5) vacuum (15 mm. Hg). Opposite sides of every ampule received 50-

procedure in rabbits.<sup>3</sup> The details of the surgical techniques as well as the fate of the recipient cornea will be the subject of a future report by us.

Normal  $\text{QO}_2$  for the rabbit cornea was assumed to be  $-0.55$ .<sup>4</sup>

All of the corneas in each ampule were used in the respiration studies, including the cornea from whose center a section was

TABLE 1  
RESULTS OBTAINED IN CORNEAS EXPOSED TO THE CAPACITRON

Media	Im-pulses	No. of Cor-neas	Storage (days)	Appearance		Respiration (/Cornea)	Culture	Transplan-tation
				Gross	Micro-scopical			
Air	2	3	24	+++		0,0,0		0
Air	4	4	40	+++		0,0,0, +		++
Air	6	3*	48	+++	+	0,0		+
Air+frozen saline	2	3	52	+		0,0	No Gr.	0 to +
Air+frozen saline	4	4	53	+	0	0,0,0	No Gr.	0
Air+frozen saline	6	3*	24	+		0,0, +		
Air+saline	2	3	27	++		+, ++, ++++		0 to +
Air+saline	4	4	42	++	++	0,0,0		0 to +
Air+saline	6	3*	49	++	++	0,0		
Nitrogen	2	3	31	+++		0,0,0		0
Nitrogen	4	4	45	+++	+++	0,0,0		+
Nitrogen	6	3*	49	+++	+	0, +	No Gr.	++
Vacuum	2	3	33	+++		0,0,0		+
Vacuum	4	4	47	+++	+	0,0,0		++
Vacuum	6	2*	24	+++		0,0		
Control		3	0	++++	+++	++++		+
Control		3	0	++++	+++	++++		++
Control		3	0	++++	+++	++++		++++

\* Scleral collars.

++++ = normal.

percent of the impulses. The ampules were all exposed at a distance of 17.5 centimeters from the aluminum window of the Capacitron.

Respiration studies were performed according to the standard Barcroft-Warburg technique. The microscopic paraffin sections were stained with hematoxylin and eosin. Beef broth was used for the culture studies. The corneal transplant surgery was performed under the handicap of our inexperience with the surgical difficulties of this

trepheined to serve as a donor tissue but excluding the corneas which were placed in fixative in preparation for histologic studies. For the bacterial culture studies, a small wedge-shaped portion was aseptically removed from the periphery of a cornea and was incubated in beef broth.

## RESULTS

The data are presented in Table 1.

a. *Gross appearance.* The fresh cornea when removed was used as a standard. Com-

pared to the fresh specimens, all of the Capacitron-treated corneas appeared to have thickened 25 to 50 percent. The transparency was diminished an estimated 33 percent. Only the corneas treated in frozen saline became an opaque milky white and swelled 100 to 200 percent of normal. All of the corneas had a rubbery consistency similar to that which results from formalin fixation.

b. *Microscopic appearance.* The specimens were sectioned in paraffin but the results were inconclusive since 90 to 100 percent of the epithelium was missing in all of the specimens, including the controls. The stroma was vacuolated (an artifact?). Descemet's membrane and the endothelium, in general, appeared normal. One of the treated corneas was placed in alcohol and was stained without passing through the usual course of fixatives. This tissue appeared to stain as corneas fixed by conventional methods.

c. *Respiration.* Six of the treated corneas showed respiration. Three of these were in the same ampule. The respiration varied from one-fourth normal to normal. Forty-one corneas showed no respiration.

d. *Culture.* None of the 3 specimens tested demonstrated any bacterial contamination. There was probably no contamination in the other ampules judged from their gross appearance and odor as compared with controls.

e. *Transplants.* Twelve of the treated corneas were used as donor material for corneal transplants to normal rabbit hosts. In one case the animal died during surgery. In another instance the lens was injured by the surgical procedure and the graft was extruded. Another developed secondary glaucoma postoperatively. Of the remainder, all corneal transplants healed satisfactorily, but the grafts remained opaque in all of the host rabbits. Several of the grafts were vascularized from superficial limbic vessels.

f. *Swelling.* One cornea exposed to the Capacitron was placed in distilled water for

72 hours. No swelling appeared macroscopically. A control, normal, fresh cornea after submersion in water for 72 hours swelled some 400 percent (by volume), enough to change its shape from the normal hemisphere to a lenticularlike mass.

g. *Controls.* Eleven fresh corneas were used for controls. Two were placed in separate ampules, one containing air, the other saline. They became greatly altered in appearance after the third day and were obviously contaminated. The remaining 9 were directly employed in corneal transplants without previous storage. The successes increased with improvement in the technique until the last group of 3 remained as clear transplants.

#### DISCUSSION

The evidence indicates that in the corneas treated with the Capacitron there is probably a denaturation of the protein molecules. This denaturation is similar to that which occurs following other types of irradiation such as X-ray and ultraviolet-ray exposures. The change is not as vigorous as occurs in such chemical fixatives as formalin. The frozen saline group were probably altered more by the freezing than by the Capacitron irradiation.<sup>5-8</sup>

The fixation hypothesis is supported by the inhibition of the respiratory enzymes and by the absence of bacterial contamination, the latter due to a denaturation of the bacterial proteins. Furthermore, the normal staining which occurred in the treated cornea with no other fixation lends support to this impression. The absence of swelling in the 41 corneas immersed in the manometer flask fluids for periods up to 3 hours and the lack of swelling in the 1 cornea submerged for 72 hours indicates that the corneal proteins were denatured. One of the unique characteristics of the normal cornea is the swelling of 300 to 400 percent when placed in water.<sup>2</sup>

If the tissue proteins are actually altered, then the uniformly poor results following

corneal transplantation are not surprising.<sup>5-8</sup> It is our impression that the discrepancy between the gross and microscopic appearances is due to the vagaries inherent in the sectioning of corneas embedded in paraffin, since it was noticed in the controls as well as the treated corneas. Sectioning of the isolated cornea for histologic examination usually results in an unsatisfactory specimen for examination. The presence of the scleral collar did not influence the response of the cornea in any of the tests.

The doses of irradiation used in these studies were high and the storage time was prolonged 10 to 25 times that which is the maximum with other techniques. It should be emphasized that the postulation of a fixation of tissue protein following exposure to the Capacitron is unproved. Therefore, the results reported should be considered as applicable only to the specific radiation conditions under which the samples were ex-

posed. It is possible that different results could be obtained with variations in the techniques.

#### SUMMARY

1. Rabbit corneas were stored at room temperature for periods up to 53 days in ampules containing various media following exposure to the penetrating electrons of the Capacitron.

2. Respiration and bacterial growth were inhibited.

3. The gross appearance was not greatly altered.

4. Corneal transplants performed with the treated corneas healed well but remained opaque.

5. The results are interpreted as probably representing a denaturation of the corneal proteins by the electrons from the Capacitron.

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#### REFERENCES

1. Brasch, A., and Huber, W.: Ultrashort application time of penetrating electrons: A tool for sterilization and preservation of food in the raw state. *Science*, **105**:112, 1947.
2. Cogan, D. G., and Kinsey, V. E.: The cornea: V. Physiologic aspects. *Arch. Ophth.*, **28**:661, 1942.
3. Stansbury, F. C., and Wadsworth, J. A. C.: Corneal transplantation in rabbits. *Am. J. Ophth.*, **30**:968, 1947.
4. Duane, T. D.: Unpublished data.
5. Smelser, G. K., and Ozanics, V.: Effect of quick freezing at very low temperatures of donor tissue in corneal transplants. *Proc. Soc. Exper. Biol. & Med.*, **62**:274, 1946.
6. Leopold, I. H., and Adler, F. H.: Use of frozen-dried cornea as transplant material. *Arch. Ophth.*, **37**:268, 1947.
7. Katzin, H. M.: The preservation of corneal tissue by freezing and dehydration. *Am. J. Ophth.*, **30**:1128, 1948.
8. Katzin, H. M., and Kuo, P. H.: Histologic study of experimental cornea transplantation. *Am. J. Ophth.*, **31**:171, 1948.



## SELF-STERILIZING OPHTHALMIC SOLUTIONS\*

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The sterilization of ophthalmic solutions has always offered a perplexing problem to the ophthalmologist. Equally as difficult has been the problem of preserving the sterility of solutions once it has been achieved. Many methods have been proposed for the sterilization and preservation of solutions.

Gifford<sup>1</sup> advised the use of boric-acid buffers in ophthalmic solutions, stating that their use prevented the growth of yeast and fungi. Hasler<sup>2</sup> advocated the use of a mixture of nipagin and nipasol, esters of benzoic acid, to prevent the growth of mold and bacteria. Haffly and Jensen<sup>3</sup> proposed placing ophthalmic solutions in rubber-capped vials, autoclaving them, and removing the necessary amounts with a sterile hypodermic syringe. The commonest method in use at the present time consists simply of autoclaving solutions prior to their use and to repeat autoclaving at intervals of 2 weeks to 1 month.

All of these methods have certain limitations to their applicability. The use of boric-acid buffers prevents the growth of fungi and some bacteria, but does not kill bacteria once a solution is contaminated. The value of benzoic acid esters as preservatives has been disputed by Spengler and Kessler.<sup>4</sup> The storing of autoclaved solutions in rubber-capped vials and their subsequent removal with sterile hypodermic syringes is not feasible for a large institution in which many patients must be treated daily. Autoclaving achieves initial sterilization, but does not maintain it and, in addition, reduces the potency of many alkaloids by as much as one half.

The ideal method is to prepare solutions which are self-sterilizing. To produce ophthalmic solutions which have this quality,

one must introduce some substance which (1) is bactericidal, (2) does not react chemically or physically with standard ophthalmic drugs, and (3) is nonirritating to the human eye.

Benzalkonium chloride satisfies most of these requirements. It is a mixture of high molecular, alkyl-dimethyl-benzyl-ammonium chlorides. It is freely soluble in water and has a pH at approximately the neutral point. It is a cationic detergent and is thus inactivated by anionic detergents—(soap).

The bactericidal powers of benzalkonium are well known. These have been investigated by Dunn,<sup>5</sup> Hoyt,<sup>6</sup> and Domagk.<sup>7</sup> It was found that benzalkonium is bactericidal to common pathogens in dilutions up to 1:35,000 at 37°C. Thompson, Isaacs,<sup>8</sup> and Khorezo,<sup>9</sup> investigated a variety of antiseptics for their rapidity and completeness of action and found that benzalkonium chloride in a concentration of 1:2,500 completely destroyed *Staphylococcus aureus* in less than one minute. Under similar conditions iodine, mercurochrome, silver nitrate, acriflavine, gentian violet, phenyl mercuric nitrate, argyrol, and merthiolate destroyed only a fraction of the organisms in five minutes. The authors concluded that benzalkonium surpassed by far the other disinfectants in its completeness and rapidity of action.

Benzalkonium chloride is compatible with practically all standard ophthalmic drugs. There are a few notable exceptions. These are argyrol, boric acid, silver nitrate, and sodium fluoresceinate. In addition, it is incompatible with nitrate and salicylate radicals.<sup>9</sup>

The effect of benzalkonium on human eyes has been investigated by O'Brien and Swan.<sup>10</sup> They found that concentrations of 1:2,500 and 1:2,000 caused diffuse superficial punctuate staining of corneas. This

\* From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital and University.

disappeared when the drug was discontinued and did not recur when the drug was used in concentrations of 1:5,000 and 1:3,000. They advised the use of benzalkonium as a wetting agent with carbaminoyl choline to promote the absorption of the drug. Scobee<sup>11</sup> used benzalkonium in a concentration of 1:5,000 in the treatment of recurrent staphylococcal conjunctivitis and reported no untoward effects.

As a preliminary to the clinical use of benzalkonium chloride in ophthalmic solutions a series of experiments was performed to determine the survival time of common pathogenic bacteria in ophthalmic solutions prepared (1) in distilled water, (2) in dis-

All solutions except those containing benzalkonium were sterilized before the addition of the test organisms by autoclaving at 15 pounds pressure for 20 minutes. Solutions containing benzalkonium were not autoclaved.

The organisms used had been recently isolated from clinical material and grown in pure culture.

To 3 cc. of each drug solution under test was added 0.05 cc. (one drop) of an actively growing 24-hour broth culture of *E. coli*, *B. pyocyaneus*, and *Staphylococcus aureus*. Subcultures were taken at intervals of 2, 5, 10, 15, and 30 minutes and planted in trypticase soy broth using a standard

TABLE 1  
SURVIVAL TIME OF ORGANISMS IN SOLUTIONS PREPARED IN STERILE DISTILLED WATER

	Coli				Pyocyaneus				Staphylococcus			
	(Minutes)				(Minutes)				(Minutes)			
	2	5	15	30	2	5	15	30	2	5	15	30
Eucatropine Hydrochloride 5%	+	+	+	+	+	+	-	-	+	+	+	+
Cocaine Hydrochloride 4%	+	+	+	+	-	-	-	-	+	+	+	+
Pilocarpine Hydrochloride 2%	+	+	+	+	+	+	+	+	+	+	+	+
Atropine Sulfate 1%	+	+	+	+	+	+	+	+	+	+	+	+
Tetracaine Hydrochloride 5%	-	-	-	-	-	-	-	-	+	+	+	+
Scopolamine Hydrobromide 1%	+	+	+	+	+	+	+	+	+	+	+	+
Eserine Sulfate 1%	+	+	+	+	+	+	+	+	+	+	+	+
Homatropine Hydrobromide 2%	+	+	+	+	+	+	+	+	+	+	+	+
Distilled Water	+	+	+	+	+	+	+	+	+	+	+	+

tilled water with zephiran, and (3) in buffer solution with zephiran.

#### MATERIALS AND METHODS

The drugs used were obtained from the pharmacy in the powdered form and were prepared (1) in distilled water, (2) in distilled water containing benzalkonium chloride\* (1:5,000), and (3) in a phosphate buffer solution of pH 7.2 recommended by White and Vincent<sup>12</sup> containing benzalkonium chloride (1:5,000). All glassware was thoroughly rinsed to remove any trace of soap prior to being used.

\* The benzalkonium chloride used in these experiments is sold under the trade name Zephiran by the Winthrop Chemical Company, Inc.

1-mm. platinum loop. After an incubation period of 48 hours the subcultures were examined for evidence of growth and the results were recorded.

#### RESULTS

The first experiment consisted in contaminating sterile solutions of 8 commonly used ophthalmic drugs prepared in sterile water with *E. coli*, *B. pyocyaneus*, and *Staphylococcus aureus*. As a control, sterile distilled water was similarly contaminated. The results are given in Table 1. Organisms survived regularly for 30 minutes in most of the solutions tested. The coli and pyocyaneus bacilli failed to survive in tetracaine (0.5 percent). This was possibly due to the

[illegible]

## COMMENT

Solutions formerly used on the wards of the Wilmer Institute were prepared for the most part in Gifford's buffers. In addition, all solutions were autoclaved prior to being placed in use. Once in use these solutions were discarded after a period of two weeks. Cultures of these solutions show that an appreciable percentage of them exhibit some degree of bacterial contamination prior to being discarded. A series of solutions containing phosphate buffers and benzalkonium (1:5,000) was prepared and placed in use without prior sterilization. There were 27 such solutions. These were cultured 2 and 4 weeks after being placed in use and on

both occasions all of the solutions were sterile. In addition, there was no instance in which the use of these solutions containing benzalkonium seemed to cause any undue local irritation or reaction.

It seems proper on the basis of these experimental and clinical findings to use benzalkonium chloride in ophthalmic solutions in order to make them self-sterilizing. The only exceptions are those solutions containing drugs with nitrate, salicylate, and fluoresceinate radicals. Benzalkonium chloride is compatible with most ophthalmic drugs and is nonirritating in concentrations necessary to achieve bactericidal effects.

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## REFERENCES

1. Gifford, S. R.: *A Hand-Book of Ocular Therapeutics*. (Revised by Vail, D.) Philadelphia, Lea, 1947, p. 54.
2. Hasler, W. T. J.: *Am. J. Ophth.*, **22**:423, 1939.
3. Haffly, G. N., and Jensen, C. D. F.: *Arch. Ophth.*, **37**:649 (May) 1947.
4. Spengler, H., and Kessler, J.: *Pharm. Acta Helv.*, **18**:660, 1943.
5. Dunn, C. G.: *Proc. Soc. Exper. Biol. & Med.*, **35**:427 (Dec.) 1936.
6. Hoyt, A., Fisk, R. T., and Burde, G.: *Surgery*, **12**:786 (Nov.) 1942.
7. Domagk, G.: *Deutsche med. Wchnschr.*, **61**:829 (May) 1935.
8. Thompson, R., Isaacs, M. D., and Khorezo, D.: *Am. J. Ophth.*, **20**:1087 (Nov.) 1937.
9. Huyck, C. L., and Davy, E. D.: *J. Am. Pharm. A.*, **8**:27 (Jan.) 1947.
10. O'Brien, C. S., and Swan, K. C.: *Arch. Ophth.*, **27**:253 (Feb.) 1942.
11. Scobee, R. G.: *Am. J. Ophth.*, **25**:184 (Feb.) 1942.
12. White, A. I., and Vincent, H. C.: *J. Am. Pharm. A.*, **8**:406 (Aug.) 1947.

## OPHTHALMIC MINIATURE

The fit time for couch of Cataracts

Couch Cataracts upon  
 a day so faire,  
 That neither wind nor  
 clouds disturbe the Ayre,  
 When spring with simples  
 fils the Earth rich lap,  
 Or Autumne makes  
 the tree put off his cap,  
 The Moore ith full,  
 or in coniunction sly,  
 Or tracing Aries,  
 or in Gemini.

Richard Banister, Mr. In Chyrurgery,  
 Oculist and Practitioner in Physicke.

## PREVENTION OF INFECTION IN EYE SURGERY\*

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Consideration of all the possibilities shows that infection in ophthalmic surgery takes place from:

*Endogenous sources*, such as (1) Systemic infection (lues, tuberculosis, septicemia, acute exanthemas, both in the active stage and during the incubation period, or even during convalescence). (2) Foci of infection (apical abscesses in the teeth, pyorrhea, and so forth; infected tonsils, accessory nasal sinus disease, and prostatitis). (3) Latent phacoanaphylaxis.

*Exogenous sources*, such as (1) Contamination residual in the conjunctiva, glands of the lids, lacrimal apparatus, and skin. (2) The hands and gloves of the surgeon, assistant, and nurses. (3) Droplet infection through the masks of the participants. (4) Dustborne organisms.

It is obviously impossible in a paper such as this to consider a problem of such magnitude in all its aspects. The discussion, therefore, will be limited to a consideration of methods for the prevention of infection resulting from contamination by the instruments used in intraocular operative procedures.

In any consideration of measures for the prevention of infection in eye surgery, it is obvious that the proper care and sterilization of the instruments used is of primary importance. Not only must the instruments be sterilized, but their sterility must be maintained up to the moment of their use in operation, and, at the same time, they must be kept in perfect condition, with edges and points sharp and free from oxidation.

### METHODS OF STERILIZING INSTRUMENTS

*Boiling in water* is probably the oldest

known and has been investigated with the greatest amount of elaboration. It may be accepted as a proven fact that boiling instruments in sterile water does not affect the edges or produce rusting, provided no electrolytic action takes place. When injury does occur, it is the result of oxidation, or mechanical mishandling.

Lancaster<sup>1</sup> quotes Roscoe and Schoerlemmer<sup>2</sup> on this point. They say: "Iron only rusts in the presence of oxygen and liquid water containing either carbonic or some other volatile acid or metallic salt in solution," and "liability to rust is diminished in the presence of alkalis."

By careful experimentation, Lancaster found that polished steel plates showed faint spots after boiling for three hours in a 1-percent solution of bicarbonate of sodium and that, after five hours, well-marked oxidation was present. But in a footnote he states: "If the sterilizer is of such material that it is acted upon by the boiling soda, it is possible to get conditions favorable for tarnishing the instruments." He did find that a solution of potassium or sodium hydrate was even more satisfactory.

It is almost impossible, however, to find sterilizers in perfect condition. Furthermore, even when this requirement is met, if a number of instruments are boiled at the same time, electrolytic action may be set up between the various instruments, or, at times, even between the blade and the handle of the same instrument.

Foster, LeMay, and Johnstone,<sup>3</sup> of Gillette Industries, Ltd., noted that while boiling in water is a simple, detergent, complete, and rapid mode of sterilization, killing all spores in five minutes, if 2-percent  $\text{Na}_2\text{CO}_3$  is added to the water, some knives are spoiled by only half a minute's boiling in it. They also find that other compounds, such as  $\text{NH}_4\text{OH}$  and Neutralin, used in dental sterilizers, produce

\*From the Department of Ophthalmology, Washington University School of Medicine. Read before the Clinical Congress, American College of Surgeons, New York, September 11, 1947.

fewer deleterious changes, but that all such procedures have their limitations. They propose the use of a substance known as A.C.10 (surgical).

A.C.10 (surgical), "is the lightest of a series of anticorrosive products developed as the result of many thousands of experiments. It consists of 95 percent of a light petroleum oil and 5 percent of a complex of sodium salts of petroleum sulphonic acids (the inhibitor). Neither the oil, nor the inhibitor alone, is an effective corrosion preventive. To obtain optimum protection in a given set of conditions of exposure to corrosive attack, both the oil constituent and the mixture of sodium petroleum sulphonates must be carefully selected and mutually adjusted for compatibility."

They find that a cataract knife, if dipped for 15 seconds in neat A.C.10, can be boiled for 55 minutes without corrosion in a 2-percent w/v solution of  $\text{Na}_2\text{CO}_3$  10  $\text{H}_2\text{O}$  in water in which 2-percent v/v of A.C.10 has been emulsified, and that, if it is redipped in neat A.C.10 every 15 minutes, it can be boiled without corrosion indefinitely. It is obvious that boiling knives for sterilization is a rather complicated and delicate procedure.

*Heating in dry air* is satisfactory in many respects, but necessitates the use of special expensive apparatus and requires at least one-half hour exposure to temperatures from 150° to 160°C. Therefore, the same set of instruments cannot be used in successive operations without necessitating tedious delays.

*Heating in mineral oil* is quite satisfactory in many respects, but it is unpleasant to handle and difficult to remove from the instruments after sterilization is completed; moreover, the temperature must be watched to prevent the development of excessive heat, with the consequent loss of temper in the steel blades. If vegetable oils are used, fresh, corrosive, fatty acids and gummy polymerization and oxidation products result at each heating.

*Exposure to formaldehyde* gas is effective, but requires special and somewhat complicated apparatus. The gas is highly deleterious to aluminum.

#### CHEMICAL SOLUTIONS

The use of chemical solutions, therefore, appears to be the most desirable method, provided suitable ones that will effect proper sterilization without damaging the instruments can be found. Many proprietary solutions have been developed. Some of these contain formaldehyde, which is definitely deleterious to aluminum. Others depend upon mercury compounds for their bactericidal activity. Those containing this ingredient have a tendency to discolor rubber, attack aluminum, glass, and varnish, and, in aqueous solutions, cause rust in steel instruments.

While the effectiveness of these preparations within their limits is unquestioned, it is obvious that a preparation avoiding these limitations, and one that can be easily compounded by any pharmacist, is desirable.

In 1926-27, the late Dr. A. E. Ewing was boiling his knives in albolene but, dissatisfied with this procedure, was experimenting with the corrosive effects of various chemical solutions. From his studies, Dr. Ewing eventually evolved the following formula, which he believed would satisfactorily answer all requirements:

	<i>Parts</i>
Liquor cresolis compound	2.4
Liquid petrolatum	16.0
Commercial chloroform	120.0
Ethyl alcohol 95% qs. ad.	240.0

It was demonstrated that knives and scissors were not injured by this solution, even after immersion in it for many days.<sup>4</sup> Since those early studies, interest in this problem continued, chiefly with regard to the development of suitable chemical solutions which should contain only such ingredients as are available under ordinary conditions at every drug store. The formula originally suggested by Dr. Ewing did not



purport to kill spores and, due to its high volatility, the chloroform was rapidly lost. A second preparation with a doubled cresol content was studied, but the volatility of the chloroform continued to be an objection. A more potent solution, and one without the troublesome chloroform constituent, was sought. As a result, the following solution was studied:

	<i>Parts</i>
Cresol (U.S.P.)	2.0
Formaldehyde (U.S.P.)	2.0
Thymol (U.S.P.)	2.0
Ethyl alcohol 95%	94.0

The results of the work done with this preparation<sup>5</sup> made it apparent that, although this solution was highly bactericidal, aluminum handles repeatedly exposed to its action began to deteriorate from corrosion. Formaldehyde was known to be the offending ingredient.

In an effort to eliminate this agent, a solution, the formula for which is now known as No. 4, was studied by Mr. William Moor, technician to the department of ophthalmology, Washington University School of Medicine, and me. It may be written:

Liquor cresolis compound	8.0 cc.
Oil of lavender	2.0 cc.
Thymol crystals	2.0 gm.
Ethyl alcohol 95%	88.0 cc.

It was demonstrated by recorded experiments<sup>6</sup> that clean instruments contaminated by cultures of various types of organisms could be sterilized by immersion in this solution for a period of one-half minute. Four and one-half minutes were required, however, to sterilize similar instruments, previously soiled by blood and serum, when subjected to the same cultures, plus a heavy concentration of spore-bearing hay bacilli.

The contention that spore-bearing organisms were killed by this solution was rather brusquely waved aside by other observers, who group it among the phenoloids, whereas liquor cresolis compound—the formula for which is—

Cresol (U.S.P.)	500.00 cc.
Linseed oil	350.00 cc.
Potassium hydroxide	14.52 gm.
Sodium hydroxide	37.05 gm.
Aquae dest. qs.	1,000.00 cc.

might rather be classified as a detergent, a detergent being considered as an agent acting as a go-between, enabling soaps to unite with and dissolve solid particles of matter; the cresol component, in this instance, acting upon the soap formed through the union of linseed oil with potassium and sodium hydroxide.

#### EXPERIMENTS IN STERILIZATION

In an effort to answer the challenge and to evaluate properly the potency of the preparation to the common spores of the hay bacillus, further experiments have recently been carried out. While it is well understood that the viability of spores varies greatly, and it is impossible to say that all spores can be killed in four minutes, the vast majority of those at all likely to be encountered in the operating room have been demonstrated not to survive such an exposure.

A number of old Graefe knives were totally immersed in a suspension of a mixture of vegetable *B. subtilis* and *B. subtilis* spores. Microscopic smears taken from this suspension indicated that the proportions were roughly 20 spores to each actively growing bacillus. The knives were allowed to rest in this culture for about five minutes, then all picked up together and placed in solution No. 4.

At intervals, as indicated in Table 1, a knife was picked from the solution, was rinsed by dipping in the indicated bath three times, and was given a single shake to remove excess moisture. The blade was then slid over the surface of an agar slant hard enough to make an indentation, and forced into the agar depths. Finally, it was plunged into a tube of broth. The agar was tryptose (2 percent), dextrose (0.5 percent), and agar (2 percent). The broth was tryptose (2 percent) and dextrose (0.5 percent). The

pH of each was 7.2. In Table 1, it may clearly be seen that, in all four experiments reported, spores were killed in less than four minutes.

This solution No. 4 has now been in use by the department of ophthalmology of Washington University School of Medicine in all eye surgery since about February 1, 1941. It has also been in frequent use at the Saint Louis City Hospital and St. Luke's

cent, occurred between that time and the use of the instruments in operation. It was demonstrated that the major part of this contamination took place through the medium of dust-borne organisms settling in the water bath in which the germicidal solution was washed from the instruments, upon the towels for drying them, and directly upon the instruments themselves, as they lay upon the table awaiting use.

TABLE 1  
RESULTS OBTAINED IN STERILIZATION TESTS\*

	15 secs.	30 secs.	45 secs.	1 min.	1½ min.	2 min.	3 min.	4 min.	5 min.
Solution No. 4, No Rinse									
Agar	++	+	+	+	+	+	-	-	-
Broth	++	++	++	++	++	++	+	-	-
Solution No. 4, Saline Rinse									
Agar	++	++	+	+	+	+	-	-	-
Broth	++	++	++	++	++	++	-	-	-
Solution No. 4, Saline Rinse Plus Aqueous Zephiran (1:3,000)									
Agar	+	+	+	+	+	-	-	-	-
Broth	++	++	++	++	++	++	-	-	-
Solution No. 4, Saline Rinse Plus Aqueous Zephiran (1:3,000) Plus Sodium Nitrate (0.5 percent)									
Agar	+	+	+	+	+	+	-	-	-
Broth	++	++	++	++	++	-	-	-	-

\* Growth is indicated by plus sign, very heavy growth by double plus sign, and absence of growth after 96 hours by minus sign.

Hospital, Saint Louis, since about that time.

During the summer of 1944, and especially the month of September, several infections occurred in the eyes of patients operated upon for cataract in the McMillan Hospital of Washington University School of Medicine. It seemed desirable, therefore, to recheck the test previously made, this time under operating room conditions. It also seemed advisable, while studying the action of the germicide, to conduct other experiments in order to determine where contamination might be taking place, if it was proved that the sterilizing solution was acting in a satisfactory manner.

From these studies,<sup>7</sup> it developed that complete sterilization was present immediately after removal of the instruments from solution No. 4, but that a very high degree of contamination, an average of 36.22 per-

cent, occurred between that time and the use of the instruments in operation. It was obvious that many of the organisms causing such a high degree of contamination must have been nonpathogenic, or no eyes would have survived intraocular surgery. It is, nevertheless, also obvious that such a high degree of contamination is highly undesirable and undoubtedly leads to infection in a large percentage of those cases where infection does take place. In fact, those cases in which eyes were lost from purulent infection showed invaders similar to those grown on agar plates exposed in the operating room on subsequent occasions.

#### AIR STERILIZATION

A means was sought, therefore, to eliminate, as far as possible, this source of contamination. In general, two methods of attack against such organisms are available: Air sterilization, or instrument sterilization

at the moment of use in operation. The first of these may be accomplished by sterile lamps, or by the infusion of various bactericidal solutions into the air through the medium of vaporizers; the second, by dipping the point of the instrument into boiling water or sterilizing solutions of sufficient potency, at concentrations noninjurious to the eye being operated upon.

Sterile lamps have been developed extensively and are in use commercially on a rather comprehensive scale. The lamps may be used with the rays directed upon the field of operation or in the duct of air conditioners supplying air to the closed room. The first arrangement is obviously impossible in the case of an eye operation; the second requires elaborate air conditioning of the entire operating room unit. Matthew Lucisch, director of Lighting Research Laboratory, General Electric Company, at Nela Park, Cleveland, has given considerable space in his recent book, *Applications of Germicidal, Erythemat, and Infrared Energy*, to a discussion of this problem, with many diagrams illustrating various ways in which germicidal lamps may be used.

Spraying the air with various bactericidal solutions gives promise of becoming a very practical and satisfactory method, under certain conditions. Dr. O. H. Robertson, of the University of Chicago, working with propylene and, more extensively, with triethylene glycol vapor, has shown that 1 cc. of this substance in 10,000 cubic feet of air is lethal to pneumococci, streptococci, and influenza virus previously injected into the air, and that, in this concentration, it cannot be detected and is noninjurious to individuals, even after long exposure to its effects. Air sterilization can be greatly improved by oiling the blankets and sheets.\*

All observers have attributed much of the air pollution to the disturbance of dust upon the floors. It is, therefore, desirable that some method to hold that dust be instituted. Pale paraffin oil is satisfactory, but becomes

slippery on tile floors. A solution of urea (5 percent), ninol (3 percent), and rocall (0.9 percent) may be substituted, but must be renewed every few days.

#### DIPPING OF INSTRUMENTS

Since all of these methods are expensive and difficult to carry out, the second method, dipping the instrument to be introduced into the eye in boiling water for 2½ seconds immediately before use, and later, into aqueous zephiran (1:3,000) for the same length of time, has been under investigation for the past two years. Nothing original is claimed for the use of boiling water in this manner, as it has been used for many years, but apparently no previous experiments have been carried out to determine its efficacy. The best practical test appears to be to what extent the contamination of numerous instruments, selected at random from the postoperative tables following cataract and other intraocular surgery, can be reduced by this method.

Investigation showed that 77.77 percent of the instruments tested when taken from these tables without the use of such procedures showed contamination of broth culture tubes inoculated by them. By the use of boiling water, it was possible to reduce this percentage to 14.28 percent. It was found, however, that boiling water was difficult to handle and increased the humidity of the atmosphere about the operating table. A sterilizing solution, therefore, was sought.

#### USE OF ZEPHIRAN

Zephiran, one of the approximately 2,000 known detergents, seemed well suited to this procedure. Belonging to the anion-active group of detergents, its action upon the ocular tissues is well understood. These experiments showed that an exposure of 2½ seconds to a 1:3,000 aqueous solution of this preparation reduced the contamination to 6.66 percent, a considerably lower figure than that obtained with boiling water.

This procedure has been in use since February 1, 1944, in all intraocular operations conducted in the operating rooms of McMillan Hospital, under the direction of the Eye Service of the Washington University School of Medicine. Since its introduction, 742 cataract operations had been done up to January 1, 1947, and 326 other intraocular procedures, with only one instance of purulent infection, a percentage of 0.09, and a figure which appears to justify the use of this sterilizing procedure in all intraocular operations.

Experiments conducted on four rabbits' eyes have shown, however, that shortly after the injection of aqueous solutions of zephiran (1:500, 1:1,000, and 1:3,000) into the anterior chamber there occurs a nebulous opacity of the corneal endothelium that tends to clear up in from 3 to 5 weeks. Atrophy of the iris, most marked in the region of the injection, appears in from 2 to 3 weeks and persists indefinitely. Synechias do not result from this atrophy.

It would appear wise, therefore, not to allow zephiran solutions to enter the anterior chamber more than necessary, recognizing, however, that the circumstances of these experiments greatly exaggerate any occurring in actual operative practice. Even after the accidental use of a solution of zephiran (1:300) for one month in the McMillan Clinic, no untoward ocular reactions were noted, but some rusting of the instruments was observed. It seemed best, therefore, to add sodium nitrate solution (0.5 percent) to the zephiran, in keeping with the recommendations of the manufacturers of this product, in order to introduce a further safeguard against rusting, the nitrite taking up any free oxygen that might be present in the solution.

#### ZEPHIRAN BATH

This use of zephiran has proved so satisfactory that it seemed wise to substitute a solution of zephiran (1:3,000) for the water bath, which has been shown to be a frequent

source of contamination. Experiments were conducted to determine whether such a solution would remain sterile after considerable periods of exposure to the air in shallow uncovered trays. Five minims of this solution were removed from a tray so exposed, at intervals for a period of five hours, and dropped into culture tubes containing sterile broth. In no instance did contamination result.

To reinforce the findings of this procedure, five instruments were cultured which had just been sterilized by immersion for five minutes in germicide No. 4 and then washed off in the zephiran bath. The first group was in the bath for 30 minutes; the second for 90 minutes. As was to be expected, in both instances the cultures remained sterile.

In practice, the zephiran bath gradually becomes cloudy from the carryover of solution No. 4 by the instruments being sterilized. It has become customary in our operating rooms to discard the solution at the end of the operating day, or sooner if turbidity becomes excessive.

#### CONCLUSION

In conclusion, the care and preservation of instruments between operations should be mentioned. Obviously, they should be removed from the operating table as soon as possible after the operation has been concluded, carefully washed in soap and water, and dried on soft towels. For sharp instruments, a small cotton pledget is probably the most innocuous material for this procedure.

After the washing and drying have been completed, one of a number of bland oils may be used in order to leave a slight film on the blades. Solution No. 4 may be used in this manner, although slight brownish stains may occasionally be observed after a considerable length of time has elapsed. If desired, these instruments can be left immersed in solution No. 4 for an indefinite period of time, certainly many years, with entire safety.

It has been noted that rusting of instru-

ments when not in use occurs much less frequently in the clinics of India, due to the generally high alkaline content of the air in that climate. It is undoubtedly true that a dry, slightly alkaline air is beneficial. Certainly, moisture and acidity should be care-

full avoided. This may be accomplished by introducing silica gel and lime desiccators into the cabinets where the instruments are kept.

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#### REFERENCES

1. Lancaster, W. B.: *Arch. Ophth.*, **30**:395-404, 1901.
2. Roscoe and Schoerlemmer: Vol. 2, p. 997.
3. Foster, J., LeMay, C. H., and Johnstone, K. I. *Proc. Roy. Soc. Med.*, **38**:465-469 (June) 1945.
4. Post, M. H., Jr.: *Am. J. Ophth.*, **11**:18-20, 1928.
5. Post, M. H., Jr.: *Tr. Am. Ophth. Soc.*, **38**:37-53, 1940.
6. Post, M. H., Jr., and Moor, W.: *Am. J. Ophth.*, **25**:579-584, 1942.
7. Post, M. H., Jr.: *Tr. Am. Ophth. Soc.*, **43**:79-97, 1945; *Am. J. Ophth.*, **29**:435-446, 1945.
8. Harwood, F. C., Powney, J., and Edwards, C. W.: *Brit. M. J.*, **1**:615-616, 1944.

#### OCULAR COMPLICATIONS OF TEMPORAL ARTERITIS\*

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Fifteen years ago, Horton, Magath, and Brown<sup>1</sup> published the original description of temporal arteritis. Since that time, including the four cases herein presented, more than 40 cases have been reported, almost 50 percent of which have shown visual disturbances. As with many new diseases, the rarity of temporal arteritis is more apparent than real, and its recognition by ophthalmologists will occur with increasing frequency. Certainly this disease should be borne in mind when an elderly patient suffers an occlusion of the central retinal artery or its branches, particularly if there is a history of head and scalp pains, painful nodules along the course of the temporal arteries, and absence of pulsation.

Within a period of a few days, we saw two cases of temporal arteritis. The first patient suffered complete, bilateral loss of vision, and the second, a loss of vision in one eye with partial recovery in the other.

\*Presented before the Pacific Coast Oto-Ophthalmological Society, May 5, 1947.

#### CASE REPORTS

##### CASE 1

*History.* An emaciated white woman, aged 70 years, was first seen on March 18, 1946. She was referred by her physician for visual disturbances in the right eye of several days' duration, followed by complete loss for five days. She had been ill for several months, had aged rapidly, and a diagnosis of influenza and anemia, possibly primary, had been made.

*Eye examination.* On examination, the pupil of the right eye was moderately dilated and fixed to light. The consensual reflex was present. The media were clear and the fundus examination was notable for its lack of findings. The veins showed a moderate dilation and a Grade-II sclerosis of the arteries was noted. The disc was normal and no edema of the retina was present. There were two small hemorrhages along the course of small vessels just above and below the temporal aspect of the disc.

The fundus of the left eye showed the

same grade of sclerosis but nothing else remarkable. Vision in this eye was 20/30, with correction, being limited by a few cortical lens opacities.

Because of the sudden onset and lack of findings, a retrobulbar vascular accident was assumed, and the patient was reassured as to the status of the left eye.

On March 26th, however, 18 days after the onset of symptoms in the right eye, visual disturbances were noted in the left eye, and the patient was hospitalized. A fundus examination on March 27th showed nothing abnormal, but the next morning all light perception was gone from this eye also. The fundus showed a moderate (1 diopter) edema of the disc and peripapillary area. The caliber of the arteries was not changed, and no segmentation of the blood column was observed. There was one small hemorrhage just above and temporal to the disc. There was no color change in the macula.

The edema faded rapidly in the course of the next few days, and the fundus of each eye showed nothing except a slight pallor of the disc. Now, a year later, both discs are very pale and the patient is well but completely blind.

*Diagnosis.* The diagnosis of temporal arteritis was not made at once. Repeated consultations with internists and a neurologist were of no help. Finally, in the course of questioning the patient, the history of nodules along the forehead and severe head and scalp pains six weeks before onset of eye symptoms was obtained. Complete absence of pulsation of both temporal arteries was noted.

The original physician was contacted and his report of earlier symptoms and findings of cachexia, anorexia, moderate fever, and lancinating pains of the face, jaw, scalp, and occiput were enough to establish the diagnosis.

The history and course were so typical that no section was taken from a temporal artery.

## CASE 2

*History.* A man, aged 68 years, whom I had refracted four years previously, came to me on March 26, 1946, with the history that he had not been well during the past winter. He had been treated by his family physician several times for influenza attacks. Recovery from each attack had been slow and seemed to take longer each time. For the past few weeks he had been under treatment for anemia, the hemoglobin count having been down to 60.

The day before the present visit, he had discovered that he could not see with his left eye. Vision in the right eye with correction was 20/40-2; in the left eye, hand movements only. Four years earlier, at the time of refraction, vision had been 20/15-3, with correction, O.U., and no pathologic condition of the eyes had been present.

*Ophthalmoscopic examination.* Findings in the right eye were negative. In the left eye, there was a slight swelling of the disc and a moderate amount of grayish edema of the macular area. The visual loss was out of all proportion to the fundus findings.

*Course.* A week later the patient was seen again. Vision in the right eye had failed two days previously. It was 20/200. The left vision had improved slightly and he was able to count fingers at three feet. The right disc was moderately swollen and there were a few grayish spots in the right macula.

Since Case 1 had been presented at the monthly meeting of the local medical society, when the second patient was next seen, he was questioned regarding pains in the temporal areas. It was then learned that he had had pains in both temporal areas over a period of several weeks. He was then seen by Dr. Mark Anthony, by Dr. David Hartin, by Dr. Andrew de Roethth, and by both of us.

The temporal arteries were hard and nodular. Pulsation could not be felt on either side. Vision in the right eye was light perception only. The disc borders were oblit-



erated and at least one diopter of swelling of the disc was noted. Upon pressing the eye, the veins became smaller and upon releasing the pressure, the blood backed up in the veins in segmented clumps and then slowly progressed centrally.

Vision in the left eye had improved to 20/60, with correction, and the swelling of the disc had disappeared.

*Pathologic report.* The patient was then hospitalized and a section of the left temporal artery was removed. There was no bleeding, so the artery was not ligated. The pathologist's report was: "Microscope shows the lumen to be practically obliterated and filled with organized thrombus in which there is marked cellular infiltration. There is also marked cellular infiltration into the muscular coat. The infiltrate is of lymphocytes, giant cells, and a few polymorphonuclear cells. There is some attempt at recanalization of the vessel."

*Pathologic diagnosis.* Mesarteritis and endarteritis of the temporal artery.

*Treatment.* The Wassermann reaction was negative. The patient was put on erythroltetranitrate when he was hospitalized (0.25 gr., every 8 hours, for 6 doses, then 0.5 gr., every 8 hours). He was kept on that for a week, and then the dose was reduced to 0.25 gr. every 8 hours, and was continued for another two weeks. It is, however, questionable about the beneficial effects of the vasodilator drug.

*Results.* This patient has been seen every few weeks since the onset of the trouble. He has faint light perception in the right eye, and vision in the left eye has continued to improve. It was 20/25, with correction, on April 1, 1947.

There is marked excavation and atrophy of both discs. Tension has been taken frequently and has never been above normal. Fields were taken several times. Those of the left eye showed gradual concentric contraction. In September, the left field was limited to 35 degrees except temporally,

which was 45 degrees. In February, the left lower temporal field was reduced to 10 degrees, with slight reduction of other areas. When last seen on April 1, 1947, it was unchanged.

Two additional cases have been seen since this paper was submitted for publication.

### CASE 3

*History.* Mrs. B., aged 81 years, was seen on August 24, 1948, in the Sacred Heart Hospital, at the request of her family physician. She had been admitted to the hospital several days previously for treatment of a skin eruption that followed administration of a sulfa drug given for symptoms of influenza and pains in the sides of her head. She said that vision in the left eye had been poor for the past two weeks.

*Eye examination* showed normal pupillary reactions and normal tension. Vision was: R.E., 20/100; with correction, 20/40; L.E., hand movements. The lens, media, fundus, and disc of the right eye were normal. In the left eye, the veins were tortuous and engorged, and there was segmentation of the lower temporal branch. Two small hemorrhages were located just below the disc. The disc outlines were blurred and the arteries were small. The temporal arteries were hard and tender and did not pulsate. Blood pressure was 190/90 mm. Hg. Blood and urine examinations were negative. The patient was put on erythroltetranitrate.

*Course.* On September 2nd, vision in the right eye failed. Examination of this eye revealed an intraocular picture similar to that of the left eye. The patient was slightly irrational at times. A piece of the right temporal artery was removed. There was no bleeding so ligation was not necessary.

*Pathologic report.* "The internal coat is absent and has been replaced with fibrous tissue. Marked increase in fibrous tissue is present throughout the muscularis, with an infiltration of lymphocytes and endothelial

leukocytes in the muscular coat."

*Pathologic diagnosis.* Obliterative endarteritis.

*Outcome.* The irrational periods recurred occasionally until the patient's discharge from the hospital on September 29th. She had become blind by the time she left the hospital. On October 12th, she died of coronary occlusion.

#### CASE 4

*History.* A woman, aged 70 years, had been ill for six months, during which time she had lost 40 pounds in weight. She suffered from pain in the scalp, behind the ears, and in both temporal areas. There were palpable, tender nodules along the course of both temporal arteries. No pulsation was present in either artery.

*Eye examination* showed the right eye to be normal with the exception of Grade II arteriosclerosis. In the left eye, there was obstruction of the nasal branches of the central artery. The temporal artery was still carrying a diminished flow of blood. There was nasal retinal edema. No hemorrhages were present. Vision was finger counting at six inches.

No further details of this case can be reported, since the patient was lost to follow up.

#### COMMENT

It is not the intention of this paper to enter into a general discussion of temporal arteritis. Several recent papers have covered the subject well. It seems probable that the name should be revised.<sup>2, 3</sup> Ocular findings alone give evidence of a more widespread affection.

We are chiefly concerned in drawing attention to ocular complications and in bringing the disease to the attention of ophthalmologists.

In this connection we should like to point out the somewhat unusual discrepancy between visual loss and lack of objective findings. This point has also been emphasized by Johnson, Harley, and Horton.<sup>4</sup> Some cases (our second case, for example) show a frank obstruction of the central artery, but several (as in our first case) give the impression that an interruption of the vascular nutrient branches to the optic nerve has been the chief factor in the visual loss. The cavernous atrophy and excavation of our second case would lend credence to this.

It seems more probable, however, that the interruption of the blood flow comes on gradually over a period of some hours or days, and thus the dramatic changes of an embolus or thrombosis with ischemic edema, cherry-red spot, and so forth do not occur. However, in our first case there was no evidence that the arterial supply to the retina was ever interrupted. It is conceivable that it was slowed enough, however, so that a prolonged partial anoxemia produced the same effect as a complete block. Perhaps both factors (the central retinal artery and optic-nerve vessels) are concerned at the same time.

The cavernous atrophy and excavation of the disc in the second case is interesting. The recent tendency<sup>5</sup> to regard these pseudoglaucomas as a result of arteriosclerotic vascular obstruction is supported by the evidence in this case.

Mention has been made of an anastomosis between the anterior deep temporal artery with the lacrimal branch of the ophthalmic artery.<sup>4</sup> It is more likely, in view of the recent trend to regard this disease as more widespread, that the ophthalmic artery is involved directly by the disease or from central vessels. This is an obscure disease and many questions remain unanswered.

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## REFERENCES

1. Horton, B. T., Magath, T. B., and Brown, G. E.: *Proc. Staff Meet., Mayo Clin.*, 7:700 (Dec.) 1932.
2. Dantes, D. A.: *Temporal arteritis. J.A.M.A.*, 131:1265-1269 (Aug.) 1946.
3. Kilbourne, E. D., and Wolff, H. G.: *Cranial arteritis: A critical evaluation of the syndrome of "temporal arteritis" with report of a case. Ann. Int. Med.*, 24:1-10 (Jan.) 1946.
4. Johnson, R. H., Harley, R. D., and Horton, B. T., *Am. J. Ophth.*, 26:147, (Feb.) 1943.
5. Duke-Elder: *Textbook of Ophthalmology. St. Louis, Mosby, 1941, v. 3, p. 3072.*

## DISCUSSION

DR. ANDREW F. DE ROETH (Spokane, Washington): I was privileged to examine both of these patients. Dr. Smith and Dr. Greene did good service to our cause by bringing up this subject. As far as I can learn, only two papers dealing with eye symptoms in temporal arteritis have been published in ophthalmic periodicals. This in spite of the fact that in half of the more than 40 cases of temporal arteritis so far published there was involvement of the retinal artery in one or both eyes.

This paper shows wise moderation in not touching upon the controversial or unclarified problems of this disease, one of which is the etiology. The inflammatory symptoms, the fever, and the focal infections point to an infectious cause, although investigations by several authors have failed to find the infectious agent. However, I want to remind you of the etiology of iritis in which the cause is probably more often than not a toxin; not a microorganism.

The histopathology of this disease, even in the clear-cut cases, resembles periarteritis nodosa and thromboangiitis obliterans. There are borderline cases that can scarcely be differentiated from the latter disease. It could be that, as Dick and Freeman suggest, the histopathologic picture of temporal arteritis is due to a certain unknown damage superimposed on the senile artery.

Another problem is the selective localization of the disease. However, the localization is not at all so selective as it seemed to be after the first publications. The same changes were found by Cooke and his asso-

ciates not only in the temporal, but also in the radial, femoral, coronary, retinal, and other arteries. If this is the situation, one may assume that occasionally the retinal artery might be involved without involvement of the temporal artery.

The third problem is that of therapy which, due to our ignorance of the etiology of this disease, cannot be specific. Assuming an infection, however, one should try the new drugs of chemotherapy, as well as the antibiotics. Vasodilators are indicated. Fortunately, Nature is kind, and the involvement of the retinal artery is not an early symptom. There is hope, therefore, that by combating the infectious cause this artery will not become involved.

In connection with the authors' second patient, the question of pseudoglaucoma could also be discussed. This patient had a typical deep cupping 8 months following the onset of the disease. I have observed a patient who had the same deep cupping, with typical glaucomatous fields and tormenting temporal headaches but with patent temporal arteries and no increased intraocular pressure. There was no X-ray evidence of intracranial lesion during 8 months of continuous observation. It seems that typical glaucomatous excavation can be produced by a vascular lesion without increased intraocular pressure.

DR. E. B. BOLDREY (San Francisco, California): The authors have mentioned that they wish to bring the ophthalmic aspects of this disease to the attention of ophthalmologists. I think that it is extremely for-

tunate that they have brought the disease to the attention of neurologic surgeons as well.

These patients come in with a complaint of pain in the temporal region or in some other area of distribution of the external carotid artery. The temporal region is the most common, of course, and hence is the source of the syndrome's name.

We have been interested in the relationship of this disease to various other diseases mentioned—generalized arteriosclerosis, Buerger's disease, and other senile vascular diseases. Also, we have been interested in its relationship to the use of tobacco.

Another factor of interest to us is the relationship, as it appears in the patient who is seen early, of this disease to migraine. Migraine, of course, is regarded as related to contraction or spasm in the distribution of the external carotid artery. It occurs in the younger age groups. Temporal arteritis, on the other hand, occurs in older age groups, but it also implicates the branches of the external carotid artery.

In both instances, pain is the presenting symptom. We have interpreted this pain as being due to irritation of somatic fibers related to the sympathetic and coming along the adventitia of the blood vessels. The proof of that relationship, of course, has been the relief of pain in a considerable number of instances after the temporal

artery or other affected branch has been cut.

We have also been interested in the possible connection between this type of disease and the arteriosclerotic senility seen in advanced age, which is related to arteriosclerosis of the internal carotid artery and its branches.

As you are aware, in the treatment of a carotid aneurysm one can tie off the internal carotid artery in the neck and also clip it inside the cranium distal to the point where the ophthalmic artery comes off, without greatly endangering vision in that eye.

In a cadaver, one can tie off both internal carotids in the neck and in the cranium, presumably trapping the ophthalmic artery, tie off one external carotid, then inject material into the other external carotid and fill the isolated internal carotid on the opposite side through the only connection it possesses, that of the ophthalmic. This shows the extent of the anastomotic relationship between the ophthalmic artery and the external, as well as the internal, carotid.

The fact that the ophthalmic artery has now been shown to be implicated in temporal arteritis, a disease that has so widely affected the external carotid, is further evidence of its clinical, as well as its anatomic connections, with both the external and internal branches of the carotid artery.

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#### OPHTHALMIC MINIATURE

Our only chance for restoring sight, when the retina has been injured by concussion is in keeping the organ quiet, in taking blood from the neighbourhood by cupping or leeches, and in the general treatment called antiphlogistic.

Sir William Lawrence, *A Treatise on the Diseases of the Eye*, 1833.

# CHRONIC SERPIGINOUS ULCER OF THE CORNEA (MOOREN'S ULCER)\*

## ETIOLOGIC AND THERAPEUTIC CONSIDERATIONS

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Chronic serpiginous or rodent ulcer of the cornea was first recognized as a clinical entity by Mooren<sup>1</sup> in 1867. Nettleship<sup>2</sup> wrote an excellent summary of the subject in 1902. He found 62 cases reported in the literature and added 11 cases of his own. The number of cases reported at the present time has not been determined but is probably over 150. Very little has been added to the knowledge of this corneal disease since Nettleship's original paper.

Numerous additional methods of treatment have been reported as successful in isolated cases, but a consistently effective treatment has not yet been established. This report includes a discussion of the clinical features, an analysis and evaluation of the various therapeutic measures, and the report of a case in which etiologic studies were made.

### ETIOLOGY

Numerous factors have been mentioned in the etiology of chronic serpiginous ulcer. Andrade<sup>3</sup> isolated a diplobacillus, and Rodigina<sup>4</sup> isolated an organism resembling *zur Nedden's* bacillus. Both investigators reported a reproduction of the ulcer in the rabbit eye. Attempts to confirm this work have been unsuccessful.

Duke-Elder<sup>5</sup> and Berens<sup>6</sup> consider it to be a disease of elderly persons, but case reports include all ages. One patient reported by Taylor<sup>7</sup> was three years of age. Age and general health are certainly not important.

Koepp<sup>8</sup> suggested a tubercular etiology and reported two cures with tuberculin injections. De Berardinis<sup>9</sup> and de Schweinitz<sup>10</sup> saw the ulcer develop following a corneal

foreign body. Other writers have related the disease to metabolic disorders and malnutrition,<sup>11</sup> trophic disturbances involving the trigeminal nerve,<sup>12</sup> deficiency of vitamin B<sub>1</sub>,<sup>13</sup> and numerous other factors.

The ulcer has been bilateral in about one fourth of the cases, sometimes several years passing before the second eye is involved.

No virus studies have been reported on chronic serpiginous ulcer. This ulcer, however, displays many characteristics of a virus disease. It is a chronic progressive lesion which shows remissions and exacerbations. It does not respond to the various chemical and antibiotic agents now available.\* Rivers,<sup>14</sup> in a recent paper, made particular note of the fact that the majority of virus diseases do not respond to these agents. The histologic studies performed have revealed predominantly a round-cell infiltration of the involved cornea. Dean<sup>15</sup> inoculated a guinea pig intraperitoneally with scrapings from an active ulcer. Sections revealed multiple lesions resembling tubercles grossly, but the histologic structure was not that of a tubercle. This could possibly have represented pock-formation of the virus. The frequent occurrence of corneal anesthesia in these cases may indicate a neurotrophic factor of virus origin. A virus is certainly the most likely cause of chronic serpiginous ulcer.

### CLINICAL PICTURE

The ulcer may occur at any age, although it is uncommon before puberty. It begins as a narrow grayish infiltration near the limbus which, in a few weeks, breaks down to form a marginal ulcer. Multiple limbal infiltrations

\* From the Department of Ophthalmology, University of Pittsburgh School of Medicine.

\* Streptomycin and tyrothricin have not been tried.

may be present which ulcerate and extend marginally to coalesce. At this stage they may resemble simple marginal ulcers.

It spreads slowly, penetrating about one third of the depth of the cornea. There is an advancing margin which undermines the superficial corneal layers, producing a gray infiltrated overhanging edge of half-dead corneal tissue with an intact epithelium. The exact depth of undermining is only realized by probing, and the full extent of corneal involvement is not appreciated until this overhanging edge is removed. Behind this active margin, healing takes place from the periphery with the development of new vessels and an ingrowth of epithelium.

Mayou<sup>16</sup> has noted that there is no tendency toward fibrous tissue formation and the healed cornea is about one-half the original thickness. Only the active margin stains with fluorescein. The ulcer spreads around the limbus, toward the center of the cornea, and sometimes into the sclera (Parsons<sup>17</sup>).

Progress is slow but not uniform, and one portion of the margin may be actively advancing while another portion is inactive. The uninvolved cornea remains clear but, unless progress is checked, the entire cornea is affected after a period of 3 to 9 months. A series of small secondary ulcers may appear in the already healed cornea. Perforation has been reported in several cases<sup>18-21</sup> following which the ulcer may heal.

Injection of the bulbar conjunctiva is very mild considering the severity of the process. Hypopyon does not occur unless there is secondary infection. A mild iritis is common.

Pain is a variable symptom. When present, it is very severe and is usually accompanied by lacrimation and photophobia. The pain is more often noted when the ulcer is actively advancing. In spite of the severe pain sometimes present, the congestion remains mild.

During the active stages, ptosis is usual but disappears after healing. The opacity of the healed cornea may clear so that the iris

again becomes visible, but vision does not improve.

#### PATHOLOGY

Microscopic studies of chronic serpiginous ulcer have been made in several cases, the most complete description being reported by Feingold.<sup>19</sup> The healed cornea, previously damaged by the ulcer, is infiltrated predominantly with lymphocytes, although a few plasma cells and an occasional giant cell may also be found. It is generally a diffuse infiltration but nodules may form. Bowman's membrane is destroyed. The area contains numerous small blood vessels with a perivascular collection of lymphocytes. The epithelium over this area is thicker, being composed of 7 to 10 layers rather than the usual 5 to 6 layers.

The active margin of the ulcer contains polymorphonuclear leukocytes and occasionally a few eosinophils. Here the cornea is increased in thickness. Bowman's membrane is intact to the edge of overhanging corneal tissue. This overhanging edge is made up of epithelium, Bowman's membrane, and superficial stromal lamellae undergoing necrosis.

The deep corneal lamellae are almost normal except for some deep vascularization. The granulation tissue may extend into sclera with loss of scleral substance.

#### TREATMENT

The treatment of this corneal disease remains an unsolved problem. The rarity of the disease prevents any single person from obtaining sufficient experience to evaluate properly the various therapeutic methods and to establish a consistently effective routine. Numerous methods of treatment reported as producing cures have subsequently failed in other cases. Some writers claim a cure with a specific drug, although in conjunction with the drug, they had used other therapeutic measures which previous authors had claimed to be effective.

Fifty-three cases in which cures are reported have been collected. A summary of these cases is presented in Table 1.



TABLE 1  
REPORTED CURES OF CHRONIC SERPIGINOUS ULCER

Therapy	Author	No. of Cases
<b>I. Cauterization (with or without curettage)</b>		
<b>A. Chemical agents</b>		
1. Used successively pure carbolic acid, formalin, and electrocautery	Shannon <sup>22</sup>	1
2. Successively, tincture of iodine, carbolic acid, and nitric acid	Stevens <sup>23</sup>	1
3. Nitric acid, 5 applications	Jackson <sup>24</sup>	1
4. 20% carbolic acid	Dufour <sup>25</sup>	2
5. Curettage and trichloroacetic acid	Risley <sup>26</sup>	1
<b>B. Physical Agents</b>		
1. Galvanocautery	Stephenson <sup>27</sup>	1
2. Galvanocautery	Frank <sup>28</sup>	1
3. Galvanocautery	Cronquist <sup>29</sup>	2
4. Galvanocautery	Krey <sup>30</sup>	2
5. Paquelin's cautery	Krey <sup>30</sup>	1
6. Electrocautery	Fisher <sup>31</sup>	1
7. Cautery and excision of overhanging edge of cornea	H. Gifford <sup>32</sup>	1
8. Cautery (type not mentioned)	Ellett <sup>33</sup>	1
<b>II. Paracentesis or Delimiting Keratotomy</b>		
1. Paracentesis (repeated 5 days, 14 days)	Fuchs <sup>34</sup>	2
2. Paracentesis (repeated 21 days)	Mayou <sup>16</sup>	1
3. Delimiting keratotomy (repeated 8 days, 10 days)	S. Gifford <sup>35</sup>	2
4. Delimiting keratotomy	Thygeson <sup>36</sup>	3
<b>III. Conjunctival Flap over Ulcer</b>		
1. Flap and galvanocautery	F. W. Dean <sup>15</sup>	1
2. Flap and trichloroacetic acid	S. Gifford <sup>35</sup>	1
3. Flap and sulfanilimide	Blaess <sup>37</sup>	1
4. Flap alone	A. C. Dean <sup>38</sup>	1
5. Flap and ulcer "scraped"	Tyrell <sup>39</sup>	1
6. Total hooding of cornea	Kreiker <sup>40</sup> (Kettesy)	3
<b>IV. Chemotherapeutic and Antibiotic Agents</b>		
1. Cyanide of mercury (1:1,500) by subconjunctival injection (2 cc.)	E. L. Jones <sup>41</sup>	1
2. Bichloride of mercury (1:2,000) by subconjunctival injection	Andrade <sup>42</sup>	2
3. Aqua formalinata (0.3:1,000 or 0.5:1,000) as an eye bath or hot fomentations	Hidaka <sup>42</sup>	1
4. Zinc ionization	H. L. Jones <sup>43</sup>	4
5. Daily application of silver nitrate (1.5%) for 3 months	Haab <sup>44</sup>	1
6. Mercuric perchloride by subconjunctival injection	Augerias <sup>45</sup>	1
7. Tincture of iodine application	Koller <sup>46</sup>	1
<b>V. Radiation</b>		
1. Beta radiation unscreened 45 to 50 minutes	Ward <sup>47</sup>	3
<b>VI. Miscellaneous</b>		
1. Excised ulcerated area and replaced with corneal tissue from rabbit	de Berardinis <sup>9</sup>	1
2. Liver extract, daily injection, and Metri cautery 80 to 85° F.	Cantillon <sup>48</sup>	2
3. Cauterized with trichloroacetic acid, high vitamin diet, and cod-liver oil locally	Townsend <sup>49</sup>	1
4. Vitamin B <sub>1</sub> injections	Suurkula <sup>13</sup>	1
5. Tuberculin injections	Koepppe <sup>9</sup>	2
Total Number of Cases		53

Some forms of treatment mentioned as effective against Mooren's ulcer are not included in this list because definite cases were not cited. Schepens<sup>50</sup> suggested beta rays or one-third to one-fiftieth erythema dose of X rays. Nettleship<sup>2</sup> performed an optical iridectomy on some cases and used a cautery in others. Fisher<sup>31</sup> reported favorable results with thyroid extract (1 gr., 3 times daily).

Although cauterization has apparently cured more cases than any other method, it has been reported ineffective in the greatest number of patients. Failure with paracentesis or delimiting keratotomy has occurred in several instances. Thygeson<sup>36</sup> found the sulfonamides and penicillin to be ineffective. Streptomycin and tyrothricin have apparently not been used. No failures have

been recorded with radiation or conjunctival flap.

#### CASE REPORT

T. B., a Negress, aged 17 years, was first seen in the university eye clinic July 22, 1947, complaining of a "spot" on the right eye which had been present for 4 months. It began as a constant burning sensation in the right eye accompanied

hemoglobin, 80 percent; W.B.C., 10,500 (with 66-percent neutrophils, 33-percent lymphocytes, and 1-percent eosinophils). The urine was normal. Sedimentation rate was 3 mm. in 60 minutes. The Wassermann and Kahn tests were negative. The Frei test was negative. X-ray examination of the chest and teeth were negative.

Treatment was begun with instillation of 0.5-percent atropine sulfate solution twice daily and

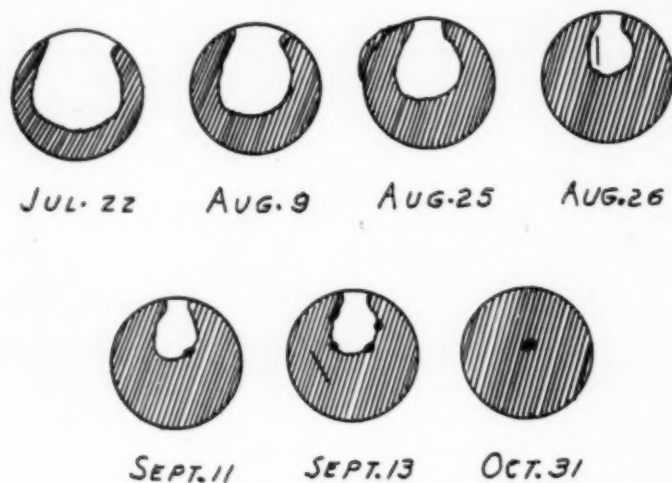


Fig. 1 (Linn). Diagram of the progress of the ulcer. The marked difference from August 25th to August 26th indicates the amount of undermining which became apparent only after the overhanging edge was removed.

by severe headaches. She was treated in another clinic for 1 month with no improvement. She was then seen by a private physician for 2 months who cauterized the "spot" twice a week with medicines. The pain stopped spontaneously 2 weeks prior to her first visit to the eye clinic.

On initial examination vision was: R.E., 20/50; L.E., 20/20. The cornea contained a large ulcerated area extending marginally from the 1- to the 11-o'clock positions (fig. 1, July 22). The edge of the ulcer was elevated, undermined, and stained with fluorescein. Corneal sensation was normal. The right upper lid was ptosed. Conjunctival injection was mild. Atropine sulfate (1-percent solution) and sulfathiazol ointment were prescribed, pending admission to the hospital.

The patient was admitted to the Eye and Ear Hospital on August 9, 1947, on the service of Dr. S. D. Evans. The ulcer had advanced since seen in the clinic (fig. 1, August 9).

Physical examination was negative except for the patient being slightly underweight. Culture and smear of the right eye were negative for bacteria. The blood count was: R.B.C., 4,080,000;

penicillin solution (1,000 units per cc.) by iontophoresis with a corneal bath twice daily. The eye was patched with penicillin ointment between treatments. The patient was also given multivitamin capsules (ABdol with vitamin C) twice daily.

One week later (August 16) no improvement was evident. Penicillin was discontinued. A subconjunctival injection of 1 cc. of 5-percent sodium sulfacetamide solution was performed and repeated in 3 days. A 30-percent sodium sulfacetamide solution was instilled every two hours during the day. A daily injection of liver extract (Lederle) was begun at the same time and continued for 5 weeks.

A week later (August 24) it was noted that the ulcer was progressing, and the patient began to have pain in the eye. Sodium sulfacetamide was discontinued. Sulfanilamide was begun, and a blood level, varying between 4 mg. percent and 7 mg. percent, was maintained. Sulfanilamide ointment was used locally.

On August 26, 1947, the ulcer was curetted and the curettings transferred to 1 cc. of sterile physiologic saline solution for use in animal studies.

The overhanging edge of cornea was excised and also saved. The excision of this overhanging edge revealed more extensive corneal destruction than had previously been recognized, as well as an extension of the ulcer into the sclera at the 10-o'clock position (fig. 1, August 25 and August 26). A muscle hook heated in an alcohol flame was applied to the active ulcer margin. A delimiting keratotomy was performed in advance of the temporal margin which appeared more active at this time.

The keratotomy incision was reopened daily for 14 days at which time it was allowed to heal over because the cornea did not take a fluorescein stain in any area, and showed no apparent activity. In the meantime, sulfanilamide had been discontinued because of a drug reaction manifested by generalized urticaria, fever, and lymphadenopathy.



Fig. 2 (Linn). Appearance of the eye on August 11, 1947.

Two days after allowing the keratotomy incision to close, a pinpoint area of the ulcer margin had broken down (fig. 1, September 11). This area was curetted and cauterized with trichloroacetic acid. In two more days several active areas had appeared (fig. 1, September 13).

Paracentesis was performed at this time in a previously involved corneal area because there was so little normal corneal tissue remaining. This incision was reopened daily for 27 days.

The patient was discharged from the hospital on September 28th and she returned for daily treatments as an out patient. Active areas remained throughout the entire period. These were curetted on several occasions and cauterized with trichloroacetic acid.

On October 10, 1947, the paracentesis was allowed to heal because no improvement was noted. Local cod-liver oil and atropine were used. The disease spread to involve the entire cornea, a single active central area remaining (fig. 1, October 31). On November 14th, a tissue culture was inoculated directly with curettings from this central area.

On January 14, 1948, there was no apparent activity of the lesion but the central corneal

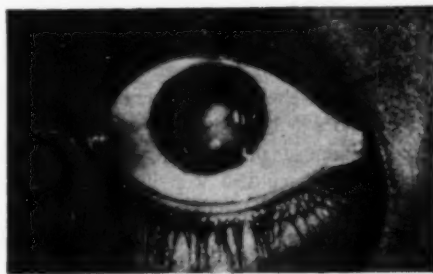


Fig. 3 (Linn). Appearance of the eye on January 28, 1948.

area was still not covered with epithelium. A few drops of the patient's own blood were instilled into the conjunctival sac and a patch was applied as used by Grossman<sup>12</sup> in the treatment of other corneal lesions. This was repeated daily for 18 days with complete healing of the cornea. At this time the opacity of the cornea obscured any observation of the iris.

On March 23, 1948, the cornea was noted to be less opaque and iris stroma was visible above and below. The patient had no ptosis for the first time since the original examination.

#### ETIOLOGIC STUDIES

Since it was felt that a virus is the most likely cause of chronic serpiginous ulcer, the attempt was made to culture a virus from this patient. Lesions have been reproduced by others in the rabbit<sup>3, 4</sup> and the guinea pig.<sup>15</sup> It was for this reason that these animals, along with chick embryos, were used in these studies.

An abraded rabbit cornea and two chick embryos (4 days) were inoculated with a saline suspension of curettings. The eggs were inoculated directly over the embryos. After incubation for 11 days, no gross lesions of the embryos were apparent. At this time, they were emulsified, and a suspension of this material was injected intraperitoneally in guinea pigs, intracerebrally in mice, and subconjunctivally in rabbits. No lesion was observed in any animal.

Corneal tissue excised from the ulcer margin which had been frozen for 3 weeks was then transferred intraperitoneally in a guinea pig and buried subconjunctivally ad-

jacent to the limbus in a rabbit. Again no lesion was produced.

Curetings from the remaining active ulcer area late in the disease were transferred directly to a 4-day old tissue culture of embryonic mouse brain. Five days later, a second tissue culture was inoculated from the first. These tissue cultures were used in 7 and 10 days to inoculate abraded rabbit cornea near the limbus, a small amount being injected subconjunctivally adjacent to the abrasion. They were also used to inject guinea pigs intraperitoneally. No lesions appeared in the rabbits and the guinea-pig peritoneum was normal to gross and histologic examination 6 weeks later.

Assuming a virus is the etiologic agent in Mooren's ulcer, several explanations can be presented to explain these negative studies. The initial curetings, procured during the very active stage of the ulcer, were diluted with saline and not used for inoculation for a period of at least 1 hour. At this time the virus concentration may have been so low as to be nonpathogenic. The chorio-allantoic membranes of the chick embryos were discarded. Viruses in general grow better on these membranes than on the embryo itself.

The inoculation of the tissue cultures was performed at the bedside, but at this time, the activity of the lesion was slight and no virus may have been present.

Sanders,<sup>53</sup> in discussing the cultivation of viruses, noted the difficulty of culturing viruses of more common eye diseases such as trachoma and inclusion blenorrhea. The ideal medium for culturing viruses affecting the eye has apparently not been discovered.

#### COMMENT

Although resolution occurred in the case reported, it is not considered to be a cure. Spontaneous resolution following complete involvement of the cornea has been previously reported. The whole blood used in this case is considered to have been important in stimulation of corneal epithelization.

Experimental studies to support this conclusion were recently reported by Newell.<sup>54</sup> It may prove effective against the active ulcer in the future, but in this patient was used after the disease process had become inactive.

The treatment used included: penicillin, sodium sulfacetamide, sulfanilamide, liver extract, vitamins, delimiting keratotomy, cauterization, and whole blood. Of this group, cauterization, liver extract, delimiting keratotomy, and vitamin B<sub>1</sub> have been previously reported as curative.

The greater majority of reported cures were in early cases. The more consistently effective therapeutic measures fail in far-advanced cases. It is, therefore, recommended that an untried new method of treatment not be used except in an early case. Even then it should be replaced by another method if no improvement results in two weeks.

The most effective procedures apparently are beta radiation, delimiting keratotomy combined with cauterization, and a conjunctival flap operation. These procedures should probably be used in the order given. If a delimiting keratotomy is effective, it will be apparent after reopening in about 14 days. A conjunctival flap should not be delayed much after that period.

Therapeutic measures worthy of further consideration are convalescent serum and whole blood locally. Streptomycin or tyrothricin may be tried.

#### SUMMARY

1. A brief discussion of the clinical and pathologic features of chronic serpiginous ulcer (Mooren's ulcer) is presented.

2. An analysis of 53 reported cures of this corneal disease is made. From this analysis it is concluded that beta radiation, delimiting keratotomy, and a conjunctival flap operation are the most effective therapeutic measures.

3. A case is reported which was treated without success. Several methods of treat-

ment were used in this patient which had been previously reported successful. Resolution of the disease occurred after the cornea was completely involved.

4. An unsuccessful attempt was made to demonstrate a virus as the etiologic agent. 500 Penn Avenue (22).

I wish to thank Dr. Murray Sanders, Dr. Phillips Thygeson, Dr. Jonas E. Salk, Dr. George R. Lacy, Jr., and Major Byron L. Bennett for their suggestions and assistance in this work. It was upon the suggestion of Dr. Thygeson that a tissue culture was made. Dr. Sanders kindly furnished this tissue culture. Dr. Salk, Dr. Lacy, and Major Bennett advised and assisted in the virus studies.

## REFERENCES

1. Mooren, A.: Ophthalmiatische Beobachtungen. Berlin, 1867. Cited by Nettleship.<sup>2</sup>
2. Nettleship, E.: Chronic serpiginous ulcer of the cornea (Mooren's ulcer), Tr. Ophth. Soc. U. Kingdom, 22:103, 1902.
3. Andrade, E.: Ulcus rodens corneae. Ann. d'otol., 29:654, 1900; abstract in Ophth. Rev., 20:167, 1901.
4. Rodigina, A.: Etiology of ulcus rodens corneae. Sovet. vestnik Ophth., 5:422, 1934.
5. Duke-Elder, W. S.: Textbook of Ophthalmology. St. Louis, Mosby, 1938, v. 2, p. 1929.
6. Berens, C.: The Eye and Its Diseases. Philadelphia, Saunders, 1936, p. 506.
7. Taylor, S. J.: Notes on a case of rodent ulcer of the cornea in a child. Tr. Ophth. Soc. U. Kingdom, 22:98, 1902.
8. Koeppe, L.: The healing of two cases of ulcus rodens corneae through tuberculin injections with observations on the microscopic anatomical examination of a third case. Ztschr. f. Augenh., 38:301, 1917.
9. de Berardinis: Case of rodent ulcer of the cornea cured by transplantation of corneal tissue from the rabbit. Ann. d'Otall., 35:385, 1906; abstract in Ophth. Rev., 26:88, 1907.
10. de Schweinitz, G. E.: Rodent ulcer of cornea with histological demonstration. Ann. Ophth., 20:436, 1911.
11. Heintz, G.: Ulcus rodens (serpiginous). Ztschr. f. Augenh., 77:289 (June) 1932.
12. Triebenstein, O.: On the question of ulcus rodens corneae. Klin. Monatsbl. f. Augenh., 82:212, 1929.
13. Suurkula, J.: Is rodent ulcer of the cornea to be attributed to a deficiency of vitamin B<sub>1</sub>? Klin. Monatsbl. f. Augenh., 102:500, 1939.
14. Rivers, T. M.: Recent advances in the treatment of viral and rickettsial diseases. J.A.M.A., 136:291 (Jan.) 1948.
15. Dean, F. W.: Treatment of Mooren's ulcer. Arch. Ophth., 11:832 (May) 1934.
16. Mayou, S.: Chronic serpiginous ulceration of the cornea (Mooren's ulcer). Ophthalmoscope, 13:438 (Sept.) 1915.
17. Parsons, H.: Mooren's ulcer of cornea. Ophth. Rev., 31:383, 1912.
18. Coppez, H.: S. Proc. Belgian Ophth. Soc., April 21, 1920; Am. J. Ophth., 4:46 (Jan.) 1921.
19. Feingold, M.: Mooren's ulcer of the cornea. Am. J. Ophth., 4:161 (Mar.) 1921.
20. Hillemanns: Ulcus cornea rodens. Arch. Ophth., 40:1, 1899.
21. Spicer, W. T. H.: A case of Mooren's ulcer. Tr. Ophth. Soc. U. Kingdom, 42:60, 1922.
22. Shannon: Mooren's ulcer four months after eye pronounced well. Arch. Ophth., 46:167, 1917.
23. Stevens, E. W.: Mooren's ulcer of the cornea. Ophth. Rec., 17:198, 1908.
24. Jackson, E.: Ophth. Rec., 17:200, 1910.
25. Dufour: Cited by Nettleship.<sup>2</sup>
26. Risley, S. D.: Discussion of de Schweinitz's paper. Ann. Ophth., 20:436, 1911.
27. Stephenson, S.: Lancet, 2:173, 1900.
28. Frank: Cited by Nettleship.<sup>2</sup>
29. Cronquist, S.: Ulcus rodens corneae. Nord. Med., 34:1449 (June) 1947; abstract in Ophth. Lit., 1:458 (Mar.) 1948.
30. Krey: Cited by Nettleship.<sup>2</sup>
31. Fisher, J. H.: Mooren's ulcer of the cornea. Tr. Ophth. Soc. U. Kingdom, 22:146, 1902.
32. Gifford, H.: Klin. Monatsbl. f. Augenh., 37:103, 1899.
33. Ellett, E. C.: Discussion of Bedell's paper. Tr. Am. Ophth. Soc., 19:188, 1921.
34. Fuchs, A.: Concerning unusual ulcers of the cornea and their treatment. Brit. J. Ophth., 17:193 (April) 1933.
35. Gifford, S. R.: Rodent or Mooren's ulcer of the cornea. Arch. Ophth., 10:800 (Dec.) 1933.
36. Thygeson, P.: Marginal corneal infiltrates and ulcers. Tr. Am. Acad. Ophth., 1946-47, pp. 198-207.
37. Blaess, M. J.: Sulfanilamide in the treatment of Mooren's ulcer, J. Michigan M. Soc., 39:249 (April) 1940.

38. Dean, A. C.: Ulcus rodens of right eye treated by a conjunctival flap. *Minnesota Med.*, 13:44 (Jan.) 1930.
39. Tyrell, F. A. C.: Case of Mooren's ulcer treated with a conjunctival flap. *Tr. Ophth. Soc. U. Kingdom*, 37:205, 1917.
40. Kreiker, A. (Kettesy): Complete covering of the cornea by conjunctiva in rodent ulcer. *Klin. Monatsbl. f. Augenh.*, 90:373 (Mar.) 1933.
41. Jones, E. L.: Simultaneous bilateral rodent ulcer of the cornea cured by combined curetting, thermocautery, and massive cyanide subconjunctival injection. *Brit. J. Ophth.*, 18:579 (Oct.) 1934.
42. Hidaka, K.: Ulcus rodens. *Ann. Ophth.*, 21:372, 1912.
43. Jones, H. L.: Treatment of corneal ulcers by zinc ions. *Brit. M. J.*, 2:526, 1910.
44. Haab: Cited by Nettleship.<sup>2</sup>
45. Augerias: Cited by Nettleship.<sup>2</sup>
46. Koller: Cited by Nettleship.<sup>2</sup>
47. Ward, R.: Radium in ophthalmology with illustrative cases. *Proc. Roy. Soc. Med.*, 26:1518, 1933.
48. Cantillon, C. J.: Treatment of Mooren's ulcer with liver extract. *Brit. M. J.*, 1:71 (Jan.) 1938.
49. Townsend, J. F.: Ulcus cornea rodens. *South. M. J.*, 31:1020 (Sept.) 1938.
50. Schepens, C. L.: Discussion of Thygeson's paper. *Tr. Am. Acad. Ophth.*, 1946-47, p. 207.
51. Fisher, J. H.: Discussion of Spicer's paper. *Tr. Ophth. Soc. U. Kingdom*, 42:60, 1922.
52. Grossman, E. E.: Treatment of corneal ulcer with blood and blood plasma. *Arch. Ophth.*, 37:779 (June) 1947.
53. Sanders, M.: Cultivation of viruses. *Arch. Path.*, 28:541 (Oct.) 1939.
54. Newell, F. W.: Stimulation of corneal epithelization with topical application of erythrocytes. *Am. J. Ophth.*, 30:1238 (Oct.) 1947.

#### OPHTHALMIC MINIATURE

A prescription for a collyrium to sharpen and strengthen vision is made of equal parts of sagapen gum, opopanax, rock salt, verdigris, white pepper, asafoetida, balsam oil, ox gall, long pepper and ginger—10 drugs in all. These are thoroughly triturated with fennel water and applied to the eyes.

Also, if a little opopanax resin is mixed with sweet basil water and rubbed on the eyes it clears vision; so does the juice of half a boiled green, unripe pomegranate, to which half its bulk of honey is added. Expose the mixture to the sun for 20 days, after which it will be ready for use.

*Memorandum Book of a Tenth-Century Oculist.*

Translated by Casey A. Wood.



## NOTES, CASES, INSTRUMENTS

### NEISSERIA CATARRHALIS ENDOPHTHALMITIS\*

REPORT OF A CASE WITH COMPLETE RECOVERY

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The case to be reported is singular in that an endophthalmitis produced by the *Neisseria catarrhalis* followed an intraocular operation on an apparently clean case and that a successful recovery followed penicillin therapy.

#### CASE REPORT

*History.* J. R., aged 24 years, an unmarried white woman, had known of her diabetes for 2½ years. She has been on 90 units of insulin daily. Five months before presenting herself for examination she noticed blurring of vision in her left eye. For the past week the right eye had become hazy.

*Eye examination* on September 4, 1947, showed mature cataracts in both eyes with vision: O.D., counting fingers; O.S., light perception. Good light perception in both eyes. The remainder of her ocular and general examination was negative including sac irrigation, bacteriologic studies of the conjunctiva, and sensitivity tests for lens antigen.

On September 18th a small conjunctival flap was laid down. A keratome section was made, iridectomy performed, and the anterior capsule of the left lens was removed. The lens was irrigated out completely, the iris roots were replaced, and the conjunctiva was reunited with interrupted silk sutures. Atropine (1 percent) was instilled and both eyes patched.

On September 20th, at the first dressing, the left upper lid was swollen and red. The bulbar conjunctiva was chemotic and the anterior chamber filled with stringy pus. The

diagnosis of endophthalmitis was obvious and the patient was taken to the operating room where the conjunctival sutures were removed. A culture was taken from the anterior chamber which was then irrigated with penicillin (2,000 units per cc.). Much stringy pus remained after the irrigation. The culture was later reported as *Neisseria catarrhalis*. No fermentation of the Gram-negative diplococcus occurred in dextrose, maltose, or lactose.

*Treatment.* Each day thereafter pads of cotton soaked in penicillin (20,000 units per cc.) were placed in the lower cul-de-sac for 30 minutes and systemic penicillin and sulfadiazine were kept up for one week.

From the time of the first dressing after the irrigation, marked improvement occurred until on October 11th the entire anterior chamber was free of discharge and the eye was white with no ciliary or conjunctival congestion.

The pupillary area was filled with a thin membrane and a small infiltration was present in the substantia propria of the cornea just below the pupillary area extending about 2 mm. in length and 1 mm. in width. The tension was normal and light perception and projection were good. Atropine (1 percent) and neosynephrin (10 percent) was continued until October 25th.

*Result.* On April 13, 1948, a Wheeler discission was done horizontally at right angles to the lines of tension in the pupillary membrane. On May 7th, with a + 14.0D. sph., vision in the left eye was 20/20; with a + 2.5D. addition for near she could read J1.

*Culture.* Animal (rabbit and cat) experiments with the culture of *Neisseria catarrhalis* produced a violent endophthalmitis after anterior-chamber inoculation. This was not at all controlled or favorably affected by streptomycin irrigations.

*Discussion.* Since seeing this case, I have had a written report from an out-of-town colleague who has seen three cases of en-

\* From the Ophthalmological Service of Dr. Raymond E. Meek, New York Eye and Ear Infirmary.

dophthalmitis produced by the *Neisseria catarrhalis* after cataract extraction. Since this organism has a common habitat in the nose it behooves all of us to be sure our masks cover our nostrils. This is offered as a theoretic precaution only, as I have not been able to inoculate successfully a blood agar plate by breathing on it at either 4, 8, or 10 inches.

In reviewing the literature, only one other author\* has reported on an intraocular infection by the *Neisseria catarrhalis*. The cultural studies as given in the two reported cases of this author are inadequate but suggest that the offending organism probably was the *Neisseria catarrhalis*. One case followed an injury by a missile of glass and another was metastatic in a patient with bronchitis.

#### SUMMARY

A case is reported of a *Neisseria catarrhalis* endophthalmitis after a cataract extraction. This organism has not been recorded previously as the cause of a post-operative endophthalmitis. The inflammation was successfully controlled by a penicillin irrigation of the anterior chamber followed by daily pledget applications of penicillin, systemic penicillin, and sulfadiazine systemically.

108 East 66th Street (21).

#### COLOBOMA OF THE OPTIC NERVE

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The atypical appearance of coloboma of the optic nerve associated with pseudoptosis, total paralysis of the superior rectus muscle, microphthalmos, absence of the macula, and defective growth of the orbit makes the following case worthy of record.

\* Salvati, G.: Panophthalmitis caused by *Micrococcus catarrhalis*: Two cases. *Lettura Oftal.*, 5: 146 (Mar.) 1928.

#### CASE REPORT

*History.* R. D., an 11-year-old boy, was brought to the eye clinic of the Brooklyn Eye and Ear Hospital, service of Dr. E. C. Place, in October, 1947. The mother stated that she first became aware of the abnormality of the right eye when the patient was 9 months old. "Crossing" and narrowness of the palpebral fissure were then noted. The mother did not have any



Fig. 1 (Bikle and Levitt). Note the microphthalmos and narrow palpebral fissure of the right eye.

illness during pregnancy. The patient had two sisters, aged 16 months and 3½ years, and two brothers, aged 5 years and 7 years. The eyes of all the other siblings were examined and found to be entirely normal.

*Eye examination.* The vision of the patient's right eye was limited to counting fingers at a 6-inch distance, eccentrically in upper nasal and lower temporal fields. The vision of the left eye was 20/15+3. The left eye was normal in all respects.

The palpebral fissure of the right eye was 3 mm. smaller than that of the left eye and the right eyeball was markedly smaller than the left, creating the appearance of a ptosis of the upper lid (fig. 1). The corneas were of equal size.

The eyes were straight in the primary

position. There was complete inability to rotate the right globe up and temporally, and there was a tendency to overshoot the right eye in the down and temporal position and the left eye in the up and nasal position of gaze.

The irides were essentially of the same color. The pupils were round. The right pupil was smaller than the left and reacted sluggishly to light. There was a faint webbed opacity attached to the posterior capsule in the nasal half of the lens, which was otherwise normal. The vitreous chamber was clear.

There was no semblance of a normal optic nerve or macular area in the fundus. At the normal nerve site there was a five-sided depressed area slightly larger in extent than that of a normal nerve, with a faint pink hue and slight irregularity of tissue margin above (fig. 2). The depression was devoid of vessels. Surrounding it there was a narrow slate-colored zone and then a broader white zone. With the binocular ophthalmoscope the appearance resembled somewhat a doughnut, the hole being the irregular depression and the ring the slate-colored and white zones which were elevated and roundish.

The main retinal vessels, which were dis-



Fig. 2 (Bikle and Levitt). Right fundus showing atypical coloboma of the optic nerve.



Fig. 3 (Bikle and Levitt). X-ray picture of orbits showing smallness of right orbit.

tributed peripherally fairly normally, coursed around the ring and disappeared just before reaching the edges of the depression. The macula was not differentiated. In its normal place, there was a diffuse honey-combing which was spread over a broad area. The peripheral fundus background had a fairly normal color. Scattered throughout the fundus there were variously sized spots of chorioretinitis of the atrophic type and dense deposits of pigment.

*Radiologic study.* Aside from the ocular abnormality the patient was healthy and normally developed. Blood Wassermann was negative. A radiologic study of the skull, orbits, and paranasal sinuses revealed that the skull vault was normal in form, thickness, and structure. The convolutional markings were not increased in depth or number. There was no diastasis or premature synostosis. There were no intracranial calcifications and no pathologic changes were apparent in the base of the skull, including the sella.

The optic foramina were normal in size and form. The right orbit was slightly smaller in all its dimensions than the left. The measurements of the right orbit were 3.8 by 3.9 cm. as compared to the left orbit which measured 4.1 by 4 cm.

The frontal sinuses were rudimentary.

The ethmoids of both sides and both antra were clear. The left sphenoidal sinus was small and clear. The right was of moderate size and slightly cloudy. There was a large mass of soft tissue density high in the nasopharynx, probably adenoid tissue.

1 Nevins Street (17).

991 Ocean Avenue (26).

### DEMONSTRATION OF TRACHOMA INCLUSIONS\*

#### A PRACTICAL AND RAPID STAINING TECHNIQUE

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(MC), U.S.N.I.

*Camp Lejeune, North Carolina*

This paper is written with the intention of bringing to the busy ophthalmologist a rapid staining technique for the demonstration of trachoma inclusions. This method is not only rapid but simple both in technique and in the reagents necessary. The need for a short cut in a busy practice was forcibly brought to my attention by two cases which I recently saw.

One was the case of a 49-year-old white woman, a native North Carolinian, who has not been out of eastern North Carolina for several years. In September, 1947, she began having pain, photophobia, and redness of the left eye. She immediately sought the aid of a practitioner who treated her for a simple conjunctivitis.

After several weeks of treatment she was referred to an ophthalmologist who made the diagnosis of uveitis, which apparently was quite correct. This was treated for several months and, in January, she was told that the uveitis had cleared but that she had another condition.

The attending physician made many tests,

all of which cost valuable time and money, but at the end of a month of X-ray studies, laboratory tests, and consultation, the diagnosis was still undetermined.

Being a United States Navy dependent, she sought aid at this hospital. Upon seeing her eye, one could not but notice a pannus which had grown down at least 3 mm. upon the cornea. The typical cobblestones of trachomatous conjunctivas were present on both upper and lower lids and also involved the caruncle. Conjunctival scrapings done at this time revealed the typical inclusions of trachoma.

The second case is that of a 23-year-old marine who stated that in December, 1946, upon returning from maneuvers in the Caribbean he first noticed pain, redness, and blurring of vision in the right eye. He was admitted to the dispensary at his activity under the diagnosis of corneal ulcer and was treated with penicillin, hot compresses, and atropine.

He did not improve, so was transferred to a naval hospital where he was treated similarly with the exception that the ulcer was repeatedly cauterized with trichloroacetic acid. It is noted in his previous write-up that he had recurrent ulcers at various points on the cornea.

He showed no improvement under this treatment and it was felt advisable to transfer him to another hospital. Here he was treated off and on with sulfadiazine in small doses, penicillin, atropine, hot compresses, typhoid vaccine, sterile-milk injections, X-ray therapy, and radium. He had numerous consultations and was found by the urologist to have chronic prostatitis. The diagnosis was then made of nummular keratitis secondary to chronic prostatitis. He was massaged and given more sulfa and penicillin but to no avail.

After eight months in the hospital the cornea finally cleared enough to send the man back to duty, and it was felt that if the prostate condition would remain quiescent the eye would not flare up.

\*From EENT Department, U. S. Naval Hospital, Camp Lejeune, North Carolina. The views expressed in this paper do not necessarily reflect those of the Navy Department.

At this time his vision was 20/40 and he had an opacity in the center of the cornea about 4 mm. in diameter. He states that his eye was still red and still felt irritated. The eye did remain rather quiescent until April 9, 1948, when he was hospitalized because of acute laryngitis. At this time the same symptoms returned and a large ulcer was noted in the center of the cornea. He was then referred to me for consultation.

Upon examining the eye, there was seen an ulcer, 3 mm. in diameter, in the center of the cornea encircled by a large area of opacification which extended through the stroma. There was marked engorgement of all the blood vessels of the eye and quite a great deal of pain. At the upper margin of the limbus there was noted a small pannus growing down upon the cornea (this condition had been discovered previously but it was felt that it was consistent with the changes of nummular keratitis). Vision at this time was limited to hand motion at three feet. Scrapings of the conjunctiva at this time revealed the epithelial cells to be loaded with inclusions typical of trachoma.

#### TECHNIQUES OF STAINING

After the scraping has been made and spread upon a clean glass slide it is allowed to fix by drying in the air. Then the slide is flooded by Wright's stain and allowed to stand the prescribed time for that particular solution, following which it is neutralized with distilled water. At the end of this neutralizing period it is washed with tap water and allowed to dry. It is then ready to examine under oil. The entire time for this procedure in our laboratory is  $7\frac{1}{2}$  minutes— $3\frac{1}{2}$  minutes for the Wright's stain and 4 minutes for the buffered mixture. However, this time varies with the solution of Wright's stain used.

This staining technique seems to me to be a boon both to the physician and to the anxious patient, since it is easily carried out in the office and may be included as a routine procedure in practice.

If one were to compare the results of this method with those of the Giemsa stain, it would be found that the inclusions stain blue in both methods but the Wright's stain gives a lighter blue. It would also be found that the nuclei of the epithelial cells stain a rather definite purple which is in contrast to the nuclei poorly stained with Giemsa stain. The time element is the big factor. Since Giemsa stain takes 24 to 48 hours and, in addition, is very sensitive to pH changes, it is not practical as an office test. On the other hand, the Wright's stain technique takes from 7 to 10 minutes and is as simple as a differential blood-smear stain.

The technique of demonstrating the inclusions in these cases has also been used in several cases of inclusion blenorrhea and seems to give ideal results in both.

#### SUMMARY

1. Two cases of trachoma are presented which were relatively far advanced. The loss of vision, time, and money could have been prevented by examining the conjunctival scrapings of these patients earlier.

2. A rapid staining technique is described for the benefit of the busy ophthalmologist. It can be done in the same manner as a differential blood smear.

3. A comparison is drawn between the Giemsa stain and the Wright's stain.

*United States Naval Hospital.*

I wish to express my appreciation to R. F. Davis, HMC, U.S.N., without whose assistance this paper could not have been written.

#### THE BILATERAL SLAB-OFF\*

R. L. SCHMIDTKE, M.D.  
*Saint Paul, Minnesota*

The use of a unilateral "slab-off" for the equalization of the prismatic effect in cases of anisometropia is not new to the ophthalmologist.

\*A condensation of an article read before the Minnesota Academy of Ophthalmology and Otolaryngology, December 12, 1947.

mologist and optician, but, to my knowledge, the use of a bilateral "slab-off" for the elimination of the prismatic effect in presbyopic patients who wear a moderately high myopic correction (myopia of about 5 to 10 diopters) has never been reported in the literature.

Several years ago a patient reported for a refraction and during the interview he complained that, since getting his first bi-

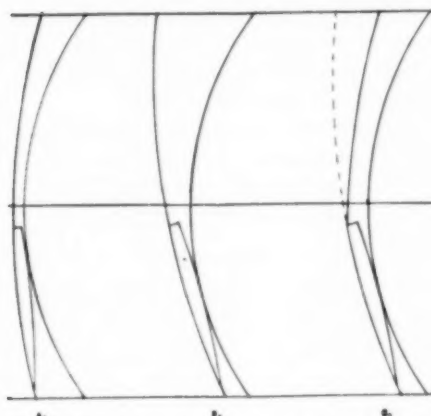


Fig. 1 (Schmidtke). The principle of grinding a bilateral "slab-off."

focals, he had been uncomfortable because, as he stated, he had a feeling of looking around the lower edge of his glasses.

During the refraction it occurred to me that this patient's symptoms were due to the prismatic effect produced by his moderately high myopic correction when using his presbyopic add for near vision. In an effort to make this patient more comfortable a flat-top bifocal segment combined with a bilateral "slab-off" was incorporated in his final prescription.

After wearing these glasses for more than a year, this patient reports that he has never had such a comfortable pair of glasses. Since then, I have prescribed this type of lens for a number of myopic patients, all of whom report greater eye comfort.

Without encroaching too much upon the optician's field I will briefly discuss the principle of grinding such a lens (fig. 1).

(A) is a diagrammatic cross section of the conventional myopic lens incorporating a flat-top type bifocal segment.

(B) is a diagrammatic cross section of this same lens into which a prism of appropriate strength and base up has been incorporated so that the optical center has been shifted from a point 2-mm. above the segment to 4-mm. below the top of the segment, thus superimposing the optical center of the distance lens over the optical center of the bifocal segment. Such a lens would be fine for close work but could not be tolerated for distant vision.

(C) is a diagrammatic cross section of the finished lens. Grinding off the prism above the top of the segment produces a new optical center for the distant part of the lens, 2-mm. above the segment, without disturbing the optical set-up for near vision, thus giving the wearer a pair of ophthalmic lenses with two optical centers—one for distant and one for near vision.

If properly made, ophthalmic lenses in which a "slab-off" has been incorporated are no more unattractive than conventional bifocals of the same power.

In cases of high myopia (myopia of 10 diopters or more) requiring a presbyopic near add, this type of lens has no advantage over the "double-myo" lens.

441 Lowry Medical Arts Building (2).



# SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

## NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

May 3, 1948

DR. DANIEL KRAVITZ, *president*

### BIOMICROSCOPY WITH POLARIZED LIGHT

DR. GEORGES KLEEFELD discussed this subject during the instruction period.

### PRESENT STATUS OF DIABETIC RETINOPATHY

DR. GEORGE ANDERSON said that diabetic retinopathy represents universal retinal vascular disease rather than arterial degeneration alone. Rupture of fragile capillary micro-aneurysmal dilatations has been described. Small, round, deep hemorrhages are probably the most characteristic feature of this specific retinopathy especially in the absence of systemic hypertension.

The duration of the diabetes rather than the age of the patient is the definitive factor. Juvenile diabetics of long duration (15 years) are especially susceptible. Only 8 percent of 200 of Priscilla White's juvenile diabetics between the ages of 20 and 39 years, who had had the disease for 15 years or more, escaped vascular degeneration (85 percent of these had retinal sclerosis; 80 percent, retinal hemorrhages).

In this series, freedom from evidence of vascular degeneration occurred only in those patients who had been well controlled. Careful analysis points to the fallacy of the argument that control of the diabetes makes little or no difference. It is almost impossible to attain 100-percent steady chemical control of the diabetes in the juvenile who is an unstable, ever-changing, growing individual. A discrepancy from complete control is countenanced by most clinicians as inevitable. As shown by postmortem statistics of Root and

the clinical results of Boyd and Jackson, control of the diabetes, difficult as it may be, pays dividends in the postponing of vascular degeneration.

In clinics where the philosophy is at variance with control, the incidence of retinitis is reported as 100 percent in juvenile cases of long duration, whatever be the degree of control. This is as would be expected when correlated with the results of those practicing meticulous control of hyperglycemia and glycosuria.

It is probable that retinopathy will not undergo substantial reduction until a smoother, automatically acting insulin, in complete homeostatic relationship with the organisms, makes total 24-hour control of the diabetes possible without sharp flings from hyper to hypoglycemia and without intermittent phases of excessive fat mobilization. These fluctuations probably exist to some extent in the best controlled diabetic under the best methods presently available.

The mildest diabetic, one with a "touch," frequently suffers from the most severe retinopathy. He is usually the neglected diabetic whose underlying disease is discovered by his alert ophthalmologist.

Effective treatment of diabetic retinopathy is essentially prophylactic and must take place in the early stages of the disease. It represents the most meticulous control of the hyperglycemia that is possible. The youthful and the adult diabetic in early stages of the disease should be treated vigorously by diet and insulin. The obese adult with beginning diabetes should have consistent, unrelenting weight reduction to improve insulin efficiency and carbohydrate metabolism. This vigorous treatment should not be applied to the elderly diabetic with advanced retinopathy.

When retinopathy has developed in the

late diabetic, the diabetic state must be sacrificed to the welfare of the eyes in order to avoid vascular catastrophe. A balanced diet, relatively high in protein for repair and maintenance of damaged tissues, a diet not calculated to reduce weight except most slowly and cautiously, and a diet that does not increase individual insulin sensitivity gives the best results.

Relative or absolute hyperglycemia must be cautiously avoided, since it causes, through compensatory adrenal response, rupture of fine fragile vessels and results in blindness. Meticulous chemical (sugar) control in these advanced patients becomes, therefore, meddlesome therapy.

At present, it would seem that few diabetics are well enough controlled to be promised freedom from eye complications. After 15 years of the disease, whatever be the age of the patient, the process is, at best, only delayed.

The evidence that diabetic retinopathy, as well as the underlying diabetes, is caused by a third and unknown condition is meager. It is likely that when the ideal, automatically acting insulin is discovered the incidence of diabetic retinopathy will approach that of a cross-section of the population for the same age grouping.

*Discussion.* Dr. Isadore Givner said that Dr. Anderson's emphasis on the importance of better diabetic control in slowing the development of diabetic retinopathy is most important. This has been the experience of others, including Rabinowich who stated that better dietary control may forestall retinal changes.

Joslin has emphasized, however, that the mechanism by which lack of control can affect the retinal vessels which induce hemorrhages is still a mystery. Yet here lies the crux of the situation for, if this factor could be established, methods of treatment might vary accordingly. Some say it is the hyperglycemia itself. This idea was championed by Graefe who stated that with-

out increase in blood sugar no sign of diabetes would occur. Others believe it is the intermediate products of metabolic change dependent upon impaired protein metabolism, hypercholesterol, and liver dysfunction.

Priscilla White called attention to Smith's work with menotoxin and suggested a like toxin acting in diabetes as a vascular poison. Acting on this suggestion, Dr. Givner said that he arranged with Dr. David Macht of Baltimore to study blood sera in patients with diabetes that had marked vitreous hemorrhages and advanced capillary fragility. A case of this type recently studied, however, showed no toxin as studied with this phytopharmacologic method.

Statistics, such as quoted from Priscilla White's patients, cannot be evaluated properly unless one knows the duration of the diabetes. Duration of the disease has been emphasized by Dolger and others as more important than the severity of the disease or the control in the incidence of retinal pathology. Comparison of the figures given in Priscilla White's series of 850 eyes with Waite and Beethan's combined series of juvenile diabetics (where only 1.7 percent of the cases showed retinal hemorrhages) shows a marked discrepancy which can be explained only on the basis of the duration of the disease in White's cases.

In spite of Waite and Beethan's dictum that the only danger from insulin, insofar as retinal hemorrhages were concerned, lay in withholding it, Dr. Givner said he was inclined to agree with Dr. Anderson. He described a recent case in which an immediate acute attack of glaucoma was precipitated by the substitution of globin insulin, with its explosive action, for the protamine zinc that the patient had been taking with no ill effects.

In conclusion he emphasized Dr. Anderson's statement that, although diabetics show a greater incidence of increased capillary fragility at each decade than nondiabetic controls, a fragility which is especially marked in cases of diabetic retinopathy, the

present therapeutic approach (vitamin C, rutin, and high protein intake) is not a specific bulwark against vascular damage. We must continue our search for more effective treatment.

#### VIRUSES IN RELATION TO ORBITAL NEOPLASMS

DR. ALSON E. BRALEY said that the possibility of viruses causing neoplasms is a reasonably old hypothesis. The first of these investigations was carried out by Borral and others in France. The infectious etiology of neoplasms must meet rigid specifications in order to explain many facts.

Dr. Braley said that in November, 1947, Mrs. Alexander and he reported on a virus obtained from a patient with a neoplasticlike lesion in the orbit. The differential diagnosis of this tumor was rather difficult to make. The possibility of exophthalmos associated with a thyrotropic hormone may have been an exciting factor. After many biopsies the diagnosis of pseudotumor of the orbit was made. This virus may be one of the causes of pseudotumor of the orbit.

There does not seem to be any relationship between this virus and the etiology of Hodgkin's disease or lymphoma, even though a great deal of the existing pathologic processes found in the tumors produced by this virus are similar to lymphomas and Hodgkin's disease.

The association of hormonal disturbances such as have been reported by Weinstein, and Aprunt and McDearman, may have some influence on the development of these neoplasms.

#### OPERATION FOR BLEPHAROPTOSIS

DR. CHARLES LITWIN said that there have been about 80 procedures described for the correction of blepharoptosis, and he wished to present (with motion pictures) a report on the Trainor operation, which he felt was simple in its performance and efficient in its results.

He said that blepharoptosis is an abnormal drooping of the upper lid and may be divided into pseudoptosis and true ptosis. The former may be caused by an abnormal widening of the palpebral fissure on one side, thus producing an apparent ptosis on the other; or it may be due to disease or increased weight of the lid on the side of the ptosis, such as occurs with edema, elephantiasis, relaxed skin, prolapsed orbital fat, blepharochalasis, trachoma, tumors, endophthalmos, spasm of the orbicularis muscle, and neurofibromatosis.

True ptosis results from inadequate lifting power of the levator palpebrae muscle and is caused by an abnormality of the levator muscle or its nerve supply. It may be congenital, acquired, or hereditary in origin; unilateral or bilateral, partial or complete.

Dr. Littwin said that there are three main types of operations usually employed for the cure of ptosis: (1) Suspension of the upper lid from the brow, thus utilizing the action of the frontalis muscle for the lifting of the lid; (2) attachment of the upper lid to the superior rectus, thereby replacing the action of the levator by the lifting power of the superior rectus; (3) enhancement of the normal action of the levator by advancing, tucking, or resecting this muscle.

A successful operation for ptosis should meet the following requirements: (1) The curve of the margin of the upper lid should overlap the cornea equally on the two sides, covering the upper part of the cornea where the lashes are normally open; (2) the margin of the lid should be a smooth curve and similar in the two eyes, with no tendency to form a notch or Gothic arch or to invert the lashes when the lid is widely open; (3) the superior palpebral crease should correspond on the two sides; (4) the eye should be capable of being widely opened and of shutting completely, both in forceful closure and in sleep; (5) normal winking should be possible; (6) the vertical distance between the eyebrow and the margin of the upper

lid should normally be the same in the two eyes; (7) the upper lid of each eye should move synchronously with the globe in all directions of gaze; (8) diplopia or disturbing heterophoria should be absent.

It is doubtful whether any operation for ptosis ever completely achieved all these requirements, especially in a case of unilateral, complete, congenital ptosis. Certainly, the frontalis type of operation does not give this degree of perfection because the upper lid can be raised only by raising the brow. The superior rectus operation nearly always weakens this muscle, producing hypotropia and leaves the lower part of the cornea exposed in sleep. Adequate resection of the levator muscle in cases of complete congenital ptosis often produces lagophthalmos in downward gaze. Therefore, in any case of complete congenital ptosis the surgeon must decide which of these criteria are the most important and which should be ignored.

It is important to make an accurate diagnosis and then to choose an operation that will produce the best possible results in each case. In the case reported, Dr. Littwin said he chose the Trainor operation because there was everything to gain and nothing to lose. The upper rectus was not weakened as in the Motais operation and, if success were not obtained, the tarsal hammock could be undone, and the condition would be no worse than it was originally.

The technique of the Trainor operation consists of using a strip of the upper boarder of the tarsus as a hammock to support the upper lid by sliding it under the insertion of the superior rectus. The steps involved are:

1. Anesthesia. Four or five drops of 0.5-percent pontocaine are instilled into the conjunctival sac. (a) The lid is everted. The needle is thrust under the loose conjunctiva, just beyond the border of the tarsus and the solution is injected until the whole retro-tarsal fold balloons out. (b) The lid is righted, and without withdrawing the needle the point is pushed to the skin side and more

solution is injected to slightly balloon out the skin. Both surfaces of the entire lid thickness are completely anesthetized. An injection is also made in the belly of the superior rectus through the conjunctiva.

2. The lid is everted and held with fixation forceps. A cut is made in the upper border through the entire thickness about 2-mm. wide, and a strip of tarsus covered with conjunctiva, but not skin, about 15-mm. long is freed, leaving it attached to the inner end.

3. The superior rectus is grasped and a tunnel is made through Tenon's capsule under the muscle by means of a scissors point.

4. The strip of tarsus is then passed under the superior rectus, either with mosquito forceps or suture.

5. The free end of the strip is now attached to its original position with one or more sutures which are bitten deep in both tarsal body and strip.

6. A protective dressing, consisting of a broad strip of adhesive, is attached to the cheek, and the lower lid is raised so as to cover the cornea. Maintaining this traction upward, a piece of gauze is used to cover the upper lid and eyebrow. The adhesive is then attached to the forehead.

#### ECZEMATOUS KERATITIS AND ARIBOFLAVINOSIS

DR. H. J. STERN AND DR. J. LANDAU presented the paper on this subject, which was published in the *AMERICAN JOURNAL OF OPHTHALMOLOGY*, volume 31, page 1619, December, 1948.

Bernard Kronenberg,  
*Recording Secretary.*

CHICAGO  
OPHTHALMOLOGICAL  
SOCIETY

February 16, 1948

DR. BEULAH CUSHMAN, *president*

## SCIENTIFIC PROGRAM

## BETA IRRADIATION OF THE EYE

DR. WILLIAM F. HUGHES, JR., presented the paper on this subject which was published in the *AMERICAN JOURNAL OF OPHTHALMOLOGY*, volume 32, page 351, March, 1949. A brief abstract follows.

Beta particles of radon represent a concentrated source of irradiation which is largely absorbed within the first 2 mm. of tissue and is therefore useful in the treatment of superficial conditions of the lid, the conjunctiva, cornea, and sclera.

The effective use of beta irradiation in ophthalmology depends upon an exact knowledge of the differential between the sensitivity of normal tissues and the pathologic tissues to be destroyed.

In general, lymphoid tissues (the follicles in vernal conjunctivitis), the epithelial growths (papillomas), and vascular endothelium (in corneal vascularization) form the most sensitive tissues which can be destroyed by beta irradiation without undue injury to the normal ocular structures.

EVALUATION OF LOSS OF CENTRAL VISION  
AND CENTRAL SCOTOMAS

DR. HELEN HOLT presented a paper on this subject. The discussion concerned the group of patients whose chief symptom was blurring or reduction of central vision with no history of associated ocular symptoms or known general illness which might have a bearing on the problem. The importance of an accurate history, evaluation of visual acuity with analysis of the manner in which the letters are read, age of the patient, and exact refraction was stressed. Central fields

were plotted on a tangent screen at a distance of 1,000 mm.

The central scotomas were grouped as positive and negative scotomas. The first type was considered as largely due to macular lesions, such as pathologic conditions of the macula, macular degeneration, macular hole, and infectious processes. The second type was due to lesions of the conducting neuron, the result of inflammatory, mechanical, vascular, or toxic processes, vitamin deficiencies, or hereditary degenerative conditions. Case histories illustrative of the various conditions with central field and fundus photographs were presented.

*Discussion.* Dr. Derrick Vail felt that Dr. Holt had presented a splendid dissertation on a subject which tends to be neglected in the modern practice of ophthalmology. Perhaps not as many of us take fields as should. Dr. Holt has pointed out the importance of this procedure, which can be time consuming but also rewarding for both patient and ophthalmologist. Particularly interesting is her discussion of patients "spotting" from one letter to another, particularly the subtle changes one may pick up unconsciously in testing the patient's distant vision. For some time he had noted that patients with negative scotoma can read charts better when the chart is not illuminated. These patients with a relative central scotoma will see the letters better than when the chart is lighted; whereas, in positive scotoma, such as central angiospasm, they will read 20/20 with the lighted chart and with the unlighted chart 20/50. Has Dr. Holt noted that?

## ANTISTINE IN OPHTHALMOLOGY

DR. PAUL HURWITZ presented this subject. An abstract of the paper, which was published in the *AMERICAN JOURNAL OF OPHTHALMOLOGY*, volume 31, page 1409, November, 1948, follows.

The antihistaminic chemical drugs and their action were briefly reviewed and 50 cases of ocular allergy and their response,



symptomatically and therapeutically, to the new antihistaminic ophthalmic solution were presented. Antistine ophthalmic solution (Ciba) was advocated for use in the symptomatic relief of patients with extraocular allergy.

*Discussion.* Dr. Louis Bothman said that when he read Dr. Hurwitz's paper he feared that he was rather too enthusiastic. The report of 84-percent good results is pretty high. His own experience with these drugs in allergic conditions was not sufficient to permit definite conclusions. With pyribenzamine in solution, the patients complained of burning and he was reluctant to use it because of the irritating effect. Dr. Hurwitz's observation that the astringent effect reduced the injection was one of the outstanding findings, and relief from itching was the principal result. Dr. Hurwitz also noted improvement in folliculosis, but he had found no change in folliculosis with any of the antihistamine drugs, although there was some relief from itching and tearing.

The patients with marked injection seemed to get more relief with privityne hydrochloride. With 0.1-percent solution they get sensitivity, and say it gives relief for 4 to 6 hours. He had seen no allergic manifestations with the use of privityne. It constricts the blood vessels and acts almost immediately. He hoped to give antistine a more extensive trial to see what it would do.

With pyribenzamine in ointment and solutions, some patients had relief from itching, but some complained of burning and refused to continue its use. About all that can be hoped for is symptomatic relief, and apparently no drug will affect the folliculosis.

Dr. Hurwitz mentioned that he had not obtained results in cases of vernal catarrh. He, himself, had seen one boy who had granulations so severe that they produced severe keratitis. After two courses of radium the involved conjunctiva was removed, and the fornix conjunctiva was transplanted to

the upper lid. Then follicles began to appear in the transplanted conjunctiva. After a period of 8 to 10 months of desensitization (during which radium and other treatment had been of no value), the granulations began to shrink and the conjunctiva in one eye became smooth. Even in this very severe form the condition is reversible. Whether this result was because of treatment of the mold sensitivity was not clear. This work should be continued, and this and other drugs should be used in the effort to relieve the patients.

DR. STEFAN VAN WEIN asked whether Dr. Hurwitz had noted any exacerbation of manifestations in the eye during the allergic tests.

Dr. Paul Hurwitz (in closing) said that possibly his percentages were a little high, as Dr. Bothman said. Individuals doing investigative work are sometimes carried away by their own enthusiasm. However, the director of the Ciba Laboratories has said that scattered reports from different areas of the country showed a 77 percent improvement in ocular allergic conditions with the use of antistine ophthalmic solution.

With regard to the burning effect of antistine, it has been noted that it is not as severe as with pyribenzamine solution. It is usually fleeting. Only one patient refused to use the solution because of the burning; a small group complained but continued to use it. The majority of patients came back for more of the solution. This indicates that they prefer the burning to the itching that is present in ocular allergies.

In reply to Dr. Van Wein, he had noted no exacerbation of the ocular lesions during the skin tests.

#### CLINICAL MEETING

(Presented by staff members, Department of Ophthalmology, University of Chicago.)

#### CONGENITAL ECTOPIC PUPILS

DR. RYERSON presented R. F., a 32-year-old white man, who came to the eye clinic



of The University of Chicago, July 23, 1947, with the complaint of inflammation of the right eye for the preceding two weeks. He gave the history of having had an operation on his left eye seven years previously in hopes of improving his vision. His uncorrected vision was: R.E., 20/100; L.E., 4/200. Examination revealed bilateral ectopic pupils. The right pupil measured 2 by 3 mm. and was displaced nasally. The left pupil measured 1.5 by 2.5 mm. and was displaced superiorly. There was a 1.5 by 3.0 mm. artificial pupil slightly below the axis of the left eye. The right eye was mildly inflamed and there was a 2+ aqueous ray.

The iritis responded well to atropine and conservative therapy. Because of his poor dental hygiene, he was referred to the dental clinic. He was treated for severe pyorrhea and several carious teeth were extracted.

The diagnostic tests were: Kahn, negative; urinalysis, negative: W.B.C., Hgb., and R.B.C., normal. Chest microfilm, negative. Old tuberculin skin test negative.

After the iritis in the right eye had cleared up a manifest refraction yielded the following correction: R.E., -0.62D. sph.  $\ominus$  +2.5D. cyl. ax. 135° gave the patient 20/40 vision. It was not possible to improve the vision of the left eye. The patient habitually squinted to see clearly and preferred this to a glass prescription. He was successfully employed as a painter.

Gonioscopic examination revealed many peripheral anterior synechias especially inferiorly. The lenses did not appear to be ectopic.

B. F., aged 15 years, a sister of the patient, presented herself primarily for our benefit. Her uncorrected vision was: R.E., 20/100; L.E., 5/200. Her right pupil was displaced toward the 10-o'clock position and the left pupil toward the 12-o'clock position. The pupils dilated poorly with homatropine, paradrine, and neosynephrin. It was not possible to improve her vision on a manifest refraction.

Slitlamp examination revealed bilateral cataractous lenses consisting mainly of peripheral punctate opacities. In the left eye, there was a beautiful display of zonular fibers. There was a slight irregularity of the equatorial portion of the left lens.

The original patient (R. F.) has children, aged 3 and 5 years, who have no apparent ocular defects.

#### NUCLEAR APLASIA AND MARCUS GUNN PHENOMENON

DR. STEPHEN J. ALEXANDER presented the case of J. C., a 4½-year-old white boy of Polish parentage, who was first seen at the University of Chicago Clinics, January 12, 1948. The mother of the child stated that since birth the right eye seemed smaller, it did not move, and the upper lid drooped.

*Past history.* No serious infectious diseases, no injuries or other defects were present. The patient was the third child born. Pregnancy, labor, and delivery were normal.

*Family history.* The father and paternal grandfather have some type of neuromuscular anomaly. The mother has a questionable left ptosis and a high exophoria. One older sister is living and well; one younger sister is living and well; one older sister died shortly after birth of "enlarged thymies."

*Physical examination.* Vision was: R.E., 10/30, not correctible; L.E., 10/20, with correction, 10/30. The facies were asymmetrical, the left side of face was most prominent. The right palpebral fissure was narrower than the left. Examination of the extraocular muscles revealed a right ptosis, partial paralysis of the right third nerve, complete paralysis of the right fourth and sixth nerves, and a Marcus Gunn jaw-winking phenomenon.

On convergence the right eye turned in less than 10 degrees and there was no movement in any other direction of gaze. The pupils reacted normally. The anterior segments and fundi were normal.

The patient is wearing the following pre-

scription: R.E., -0.75D. sph.  $\ominus$  +3.25D. cyl. ax. 105°; L.E., -0.25D. sph.  $\ominus$  +2.25D. cyl. ax. 92°.

Dr. Douglas N. Buchanan of the department of neuro-pediatrics confirmed the above diagnosis.

#### SARCOID UVEITIS

DR. A. W. FELDMAN presented Mrs. B., a 59-year-old white woman, who first came to the eye clinic of The University of Chicago with a number of minor complaints and the significant complaint of moving black spots. Her past history revealed that she had been discovered to have diabetes one year previously. Her corrected vision was: R.E., 20/40; L.E., 20/25. The eye was somewhat injected but the patient had a mild bilateral conjunctivitis at the time. The media of the right eye were slightly hazy. Slitlamp examination of the eye revealed numerous mutton-fat keratic precipitates and a 1+ aqueous ray. The patient was started on 5-percent homatropine and later switched to atropine. On one occasion, a few small perivascular exudates were seen near the macula.

The patient had all her mandibular teeth extracted on the recommendation of the dental clinic because of a nonsuppurative periodontitis. The metabolism clinic has easily controlled her diabetes with moderate dosage of insulin and diet.

Because of a peculiar dilatation of the vessels of the nose, the patient was referred to dermatology. A tentative diagnosis of lupus pernio was made. This was later confirmed, as a biopsy of the nose revealed sarcoidosis. The dermatologists instituted calciferol therapy (high vitamin D). Shortly thereafter, the nose became quite painful and a crusted lesion developed. This cleared up when the calciferol was stopped. X-ray studies of the hands and feet and of the chest did not reveal evidence of sarcoidosis.

The vision of the right eye dropped to hand movements at two feet and at times the eye was quite painful. Atropine therapy had to be discontinued because the patient be-

came sensitive to atropine. A secondary cataract developed and there was some deep vascularization of the cornea. The left eye remained essentially normal.

The following diagnostic and laboratory tests were performed: Old tuberculin, 1:10,000 and 1:1,000, negative; W.B.C., 10,800; Hgb., 16.2 gm.; R.B.C., 5.28 million; sedimentation, 27 mm.; urine, usually negative; highest fasting blood sugar, 115 mg. percent; serum calcium, av. 10 mg. percent; serum phosphorus, 3.8 mg. percent; alkaline phosphatase, 2.4 units. Plasma proteins: Albumin, 4.70 mg. percent; globulin, 2.54; A/G ratio, 1.85. Petechial count, 11 (Thompson).

This case is somewhat unusual from the following standpoints: (1) Although the general pathologic processes associated with sarcoid uveitis are spotty, they are usually located in the lungs and lymph glands. The lesion responsible for diagnosis in this case was located in the skin; (2) sarcoid uveitis is usually painless, but in this case there was considerable associated pain, although there was no evidence of secondary glaucoma; (3) sarcoid uveitis is bilateral in the majority of cases but was unilateral in this case.

#### SALZMANN'S CORNEAL NODULAR DYSTROPHY

DR. P. G. WOLFF presented Mr. J. A. H., a 58-year-old machinist, who was first seen in the eye clinic of The University of Chicago on February 21, 1944, complaining of sudden loss of vision in the left eye, following the extraction of 10 teeth, about 6 weeks previously. Aided vision was: R.E., 3/200; L.E., 20/30, not improved by a 1-mm. pinhole. A thrombosis of a branch of the left superior temporal retinal vein was found. This gradually resolved and four months later vision of the left eye had improved to 20/20+.

A rather vague history of the cause of the poor vision in the right eye was the best that could be obtained. First, at the age of 8 years this eye was very irritated and painful at irregular intervals. No doctor was consulted

and this spontaneously ceased about two years later without any recurrence of either pain or other annoyances. By the age of 15 years vision in the right eye was already noticeably decreasing and it has continued its unrelenting, slow, steady decline ever since. All eye doctors that he had seen advised that there was nothing to be done.

The patient did not believe that any of his seven siblings, his parents, or other relatives had had any "eye trouble." There was no history of consanguinity.

General physical examination revealed a moderate hypertension, mild generalized osteo-arthritis, and a fused left hip. There were conflicting opinions as to the nature of the etiology of the last-mentioned condition, but the Crile Clinic in Cleveland told him it was "acid fast" about 30 years ago. In addition, X-ray examination revealed old healed apical lung lesions. Old tuberculin, in 1/1,000 dilutions, gave a negative skin test. Repeated blood findings, including the Kahn test, and urinalyses were negative.

Objective examination of the left eye was negative except for some thinning of the left cornea without any opacifications in the inferior temporal region and for moderately advanced arteriosclerotic vessel changes in the retina.

The right eye never showed evidence of irritation or infection during observation. The right cornea was of normal size and shape, measuring 11 by 10 mm., and, except for the elevation of the nodules, was of normal curvature. Its sensitivity was reduced about 50 percent.

The pathologic changes were in a horizontally oval pattern, extending the breadth of the cornea and measuring 5 mm. in the vertical diameter. This pattern consisted of 5 elevated, blue white, structureless, opaque nodules, clearly showing that they had been formed by the union of previously existing small nodules, all lying in the superficial stroma.

The posterior one half of the cornea was normal. This cornea had never taken a

fluorescein stain. All about its margin and passing over the limbus could be seen many fine superficial blood vessels on their way to the nodules. The central and the peripheral superior and inferior portions show a diffuse superficial gray clouding through which the underlying structures could be seen to be of normal appearance. The pupil reacted promptly.

With the slitlamp there could be found no regular obstruction of the dystrophic nodules, although their centers were uniformly more elevated and white than the surrounding periphery. They were observed to extend forward some one-half the normal thickness of the cornea. The corneal nerves were observed as normal. One pupillary nodule prevented a fundus study but repeated peripheral and Bjerrum fields of this eye revealed nothing abnormal.

While under observation for the past four years, there has never been any irritation or inflammation in the right eye; there has been neither apparent advancement or the disease nor any evidence of involution. To date, no evidence of involvement of the left cornea can be seen.

Richard C. Gamble,  
*Secretary.*

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LOS ANGELES  
OPHTHALMOLOGICAL  
SOCIETY

February 5, 1948

DR. ORWYN ELLIS, *chairman*

SYMPOSIUM ON ORBITAL IMPLANTS

DR. CLARENCE ALBAUGH stressed the criteria of a good implant.

1. Adequate blood supply to prevent slipping of the muscles from their attachment to the implant.

2. Avoidance of pressure on the conjunctiva.

3. Protection of the cul-de-sac.

4. Even weight distribution between the

muscles and the lower lid by a floating-type appliance over the implant. These criteria were satisfied by a new type of basket implant as devised by Dr. Albaugh. A motion picture clearly demonstrated these points.

DR. ORWYN ELLIS described his covered implant which has been used successfully by a number of men. The implant consists of a lucite ball with an anterior ring. In 80 cases in which the implant has been used for over 10 months there was only one instance of extrusion. Dr. Ellis stated that since Tenon's capsule and the conjunctiva are fused to the sclera for 1 mm. to 2 mm. around the limbus, removal of the globe cannot be replaced with more than an 18-mm. sphere. He demonstrated his implant by the use of slides.

DR. GEORGE KILGORE of San Diego (by invitation) reported on the work at Dibble Hospital during the war. He found that the Cutler basket implant gave poor results, perhaps from faulty technique, and that it was frequently extruded. It was given up because of the atrophy above and behind the implant, and the Cutler doorknob implant was used. Good results were seen in some cases with the doorknob type but extrusion also occurred. He described three cases in which the doorknob implants were used.

1. The medial rectus pulled from its attachment postoperatively and could not be reattached, so it was removed and a basket implant was substituted.

2. A doorknob implant was placed successfully for two weeks and then the medial rectus pulled loose. A basket type was tried but was extruded because of infection but was later successfully placed.

3. Ideal movement was noted but the eye chattered when the patient read because the pin was too loose in the implant. Convergence was good as well as the vertical and lateral movements.

The important points to consider, according to Dr. Kilgore, are:

1. An additional pursestring suture through Tenon's capsule and the conjunctiva to take the strain off the muscles and allow them to heal well.

2. The medial rectus will tear loose if the good eye is uncovered too soon.

3. Penicillin and sulfa drugs should be used to keep down any infection and allow better healing.

4. Lag of movement seen with the basket type can be prevented by the doorknob implant.

DR. GEORGE LANDEGGER stated that the most important thing in an implant was permanency and that an implant covered with conjunctiva was best. Good movement in the extremes of rotation were not necessary. The larger size implants were favored since some of Tenon's capsule was gained from that stripped off the muscles. He favored the Ellis implant, having used it successfully in 7 cases. In one case, however, the implant was extruded from an inflamed orbit.

DR. GILBERT STRUBLE said that the buried implant always has a lag in movement and cannot make the excellent appearance of the Cutler and Ruedemann types. He used the 24-mm. size, earlier type Ruedemann implant in over 20 cases but all were failures since strabismus developed in all the patients when the backs of the prosthesis moved postoperatively. Sensitivity to the acrylic of the implant caused great thickening of Tenon's capsule and eventual extrusion of the eye.

The more recent mesh-type Ruedemann implant had not been observed by Dr. Struble. He had to remove three of the Cutler ball and ring implants because of recurrent cellulitis, and these were successfully replaced with glass balls. He felt that the Cutler basket implant gave a poor appearance because of the depression of the sulcus of the upper lid. Bone balls were condemned since draining sinuses were produced and the fragments of bone were so hard to remove.

Dr. Struble has gone back to using the old type of transplants since he felt there was a violation of general surgical principles in trying to attach muscles to nonviable tissue. The ideal volume size to be replaced by the implant was 18 to 19 mm. The muscles were not drawn over the implant since they were of no added help. A pressure bandage was applied for a week.

DR. GEORGE ZUGSMITH favored an implant of the Ellis type which has complete covering of the implant by the conjunctiva. He felt that eviscerations with scleral implants gave the best results and believed that this was the best operation in all cases except sympathetic ophthalmitis, tumors, and in old and debilitated patients where an implant wouldn't be used anyway.

MR. TED KAISER (by invitation) discussed prostheses as related to the type of implant. He said the implant will not move more than the cul-de-sac and that subse-

quent shrinkage which occurs after surgery accounts for the limitations. The appearance was best in eviscerations with scleral implants. Some basket implants pull the conjunctiva forward into the basket and thus foreshorten the socket and give a poor fit. Sewing up the posterior rent in Tenon's capsule after enucleation, as advocated by Dr. Rodman Irvine, has given good support since it brought the implant farther forward.

DR. ABRAHAM also emphasized the value of a large cul-de-sac to allow full movement of the implant and thus explained why eviscerations seemed to have better movement.

DR. LOUTFALLAH stressed the technique of a careful enucleation and the use of the obliques to hold the eye forward. He mentioned the new AO implant which combines the Cutler and Ruedemann principles.

Daniel B. Esterly,  
*Secretary.*

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#### OPHTHALMIC MINIATURE

I am very sincerely solicitous for the preservation or curing of Mr. Langton's sight, and am glad that the surgeon at Coventry gives him so much hope. Mr. Sharpe is of opinion that the tedious maturation of the cataract is a vulgar error, and that it may be removed as soon as it is formed. This notion deserves to be considered; I doubt whether it be universally true; but if it be true in some cases, and those cases can be distinguished, it may save a long and uncomfortable delay.

Boswell's Johnson, letter to Bennet Langton, October 18, 1760.

# AMERICAN JOURNAL OF OPHTHALMOLOGY

*Published Monthly by the Ophthalmic Publishing Company*

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## THE NEWLY BLINDED

The ophthalmologist's responsibility to his newly blinded patient should not cease at the termination of his professional services. The losing battle to save sight is a hard and difficult one, encompassed by physical and emotional distress on the part of the patient and much soul-searching, mental anguish on the part of the surgeon, who dies a little every time one of his patients becomes hopelessly blind. There is little comfort here in the words of Hippocrates, "The art is long, life is short, experiment perilous, decision difficult."

The honest struggle to do everything possible and to see to it that everything possible is done for the patient usually ends up with the patient being grateful to his physician for his care, even if futile, and the latter filled with respect and admiration for the patient's fortitude in adversity. The terrible fight has engendered a mutual regard and friendship that deserves cultivation.

Many new and good things in the training of the newly blinded came out of the experience of the last war, especially from the program established by the Army at Old Farms, Avon, Connecticut. These new techniques



and methods of approach to the problem have been carried on and applied to the civilian needs, not as yet, however, to the fullest possible extent. The keynote of the modern philosophy in this field is that of instilling and fostering self respect in the afflicted individual. The training is long, often seemingly brutal, generally agonizing, frequently affected by setbacks, but to be successful always honest and frank. Experience has shown that the sooner the newly blinded person starts on learning how to be blind the better.

In a recent pamphlet, *The Newly Blinded*, printed for distribution by the Seeing Eye, Inc., Morristown, New Jersey, there is this statement that sums up the situation. "If newly blinded men and women are approached and looked upon as normal human beings; if they are given sympathetic understanding rather than maudlin sentimentality; if an effort is made to assure them that they still have their rightful place in the family and the community; and if they are encouraged to lead active lives in spite of blindness; then a true service will have been rendered not only to them but to their families and to the Nation."

The ophthalmologist is the last line of defense against blindness. He should be the first line of offense against the depression and gloom that envelop it. His fitness for this task depends upon his training and wisdom. It is his stern duty to exert his capacity as wise physician, friend, and counsellor. It is an integral part of his responsibility to his patient. It is not to be yielded up until the blind person is properly guided into the new career and terrifying experience of blind living in a seeing world.

In order properly to discharge this responsibility, the ophthalmologist should know much about the new techniques. He should know to what proper agencies in his community he can direct his charge. Most of these agencies are good and noble, others less so. He should be familiar with the Talking Book, the Braille watch, the writing guides,

the Seeing Dog, and all of the other auxiliary things and services that splendid and generous people have made available.

A small but most important aid in this first approach is the pamphlet, *The Newly Blinded*, already referred to. It is brief and austere, worthy of the beauty of its philosophy of help and of its great service to the patient and his family. The paragraphs on orientation, walking, personal appearance, table etiquette, smoking, Braille, the Talking Book, watches, handwriting, typewriter, recreation, theatre and movies, family, and employment are short but adequate. They were written by blind men out of their experience.

The Seeing Eye, Inc., of Morristown, New Jersey, will supply physicians and the personnel of hospitals with copies of this manual upon request. Each ophthalmologist should have a few on hand against the need. Derrick Vail.

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#### PONTOCAINE ALLERGY: TECHNIQUE OF INSTILLATION

On page 263 of the February issue of the JOURNAL, Thomas W. Cowan reports a striking case of allergy to pontocaine, manifested by redness, swelling, and itching of the skin of the lids after removal of a chalazion. The patient subsequently gave a rather violent reaction to a patch test on the arm.

The author's description of the technique of anesthesia in this case suggests certain comments on the customary routine employed for instillations not only of pontocaine but of other drugs. From observation of instillation as practiced in a number of hospitals, clinics, and offices, by surgeons and nurses, I am disposed to believe that this apparently minor field of daily technique may be open to general improvement.

Allergic reactions do not always depend upon the amount of offending substance involved. But sometimes they do, and it is better not to employ more of a drug than is necessary for the effect desired. It is also to be noted that the cornea and conjunctiva

sometimes appear to be less sensitive to a given drug than is the surrounding skin. This is true of atropine, which may produce an annoying skin reaction but much less disturbance of the conjunctiva. However, some of this apparent difference in sensibility may be credited to the fact that the tears are constantly active in removal of instilled drugs, while the skin has no such protection.

The eye itself is capable of absorbing only a very small quantity of the instilled solution, from the thin film of the drug which spreads over the conjunctiva and cornea. Moreover, under ordinary circumstances, out of the much larger quantity ordinarily dropped on to the eye at one application, only the amount of a single small drop remains in contact with the eyeball, the remainder being promptly spilled over the lid margin.

(It may be worth while to mention here, especially as bearing on the mixing of small quantities of dilutions, that the drop from a medicine dropper whose tip has an inside caliber of 2 mm. is not a minim but only about three fifths of a minim.)

Thus, of the "two or three drops" (rather frequently much more) dropped upon the eye by an assistant or nurse, most of the drug stays on the skin of the face, without surgical benefit, but always capable of irritating the skin. For ordinary purposes, no more than one drop of 0.5 percent pontocaine is necessary, if properly instilled. This is plenty for removal of a superficial foreign body from the cornea, although rather more is sometimes required for a foreign body close to the limbus. The cornea is usually insensitive as soon as the burning experienced by the patient from the instillation has ceased. The greatest efficiency is obtainable by laying the last joint of the left thumb flat on the upper lid and brow while the patient looks down, sliding the lid and brow up on to the forehead, with gentle but uniform pressure, and then placing the single drop on the sclera above the cornea—not allowing the drop to fall from a rather considerable height.

In using instilled pontocaine as a preliminary to infiltration, I have not found it necessary to make more than one such preliminary instillation. In advising the mother how to instill atropine in a young child, prior to refractive estimation, I emphasize that at each instillation only sufficient solution to make a single drop should be drawn into the dropper.

Some evidence of allergy to pontocaine has been experienced by me on a few occasions after repeated use of 0.5-percent solution of pontocaine, in connection with the permission rarely given to a workman to employ such a solution in carrying on important work after burn from a welding arc, or other minor injury. Special interest attaches to Cowan's case, on account of the severe reaction and the apparent complete lack of previous use of the drug.

W. H. Crisp.

#### SURGICAL TREATMENT OF HETEROTROPIA

The best method of surgical treatment for noncomitant heterotropia has long been a subject of controversy. As has happened in so many other controversies, two schools of thought have arisen. One school favors a direct attack on the paretic muscle by the performance of one of the strengthening operations. The opposite school prefers an attack on the direct antagonist of the paretic muscle by some one of the so-called weakening operations.

The latter school owed its existence almost solely to the frequent and often rather remarkable "recoveries" of paretic muscles when the opposition of their direct antagonist was purposely decreased.

The explanation generally accepted has been that a paretic muscle, when antagonized by a normal muscle, never had the chance to regain normal tonus even after the original cause of the paresis had ceased to exist; presumably the once paretic muscle was put on such a stretch due to partially unopposed ac-

tion of the antagonist that it failed to function normally while the antagonist meanwhile became spastic and thus continued its dominant role even after the cause for the paresis had disappeared. Proponents of the "weakening operation" could thus point to a fairly satisfactory percentage of surgical "cures." Their explanation for these satisfactory results was always suspect and lacking in real proof.

Those favoring a direct attack on a paretic muscle objected to any weakening operation on quite logical grounds. The mere fact that one muscle is weak is a poor excuse for weakening another and trying to strike a balance in the degree of weakness, as it were. The school favoring the strengthening operation for paretic muscles can also point to a respectable percentage of surgical "cures."

Both schools explained their failures by saying that the paretic muscle was just "too weak." The "weakening" school believed that the paretic muscle was too weak to regain any tonus and then resorted to some "strengthening" operation as a second procedure. Those in the "strengthening" school state that it is perfectly obvious that shortening a completely paretic muscle will not enhance its effect in the slightest except, perhaps, as an anchor.

There the discussion comes to an end with no satisfactory decision in favor of either side.

It must be said that the "strengthening" school apparently had a better explanation for their failures than did the "weakening" school. Since each school is able to present a fair percentage of successful cases, it would be highly significant if the failures could be explained on some logical grounds. It would seem that perhaps the failures of one school may be the successes of the other and vice versa. If cases could be properly classified prior to surgery, then the proper mode of attack—strengthening or weakening—would be clear and the general batting average of both schools might rise to far more satisfactory and impressive heights.

Some light is thrown on the subject by always using the phrase "apparently paretic" instead of just "paretic." The idea of apparent paresis rather than real paresis opens a new line of thought. What would cause a muscle to appear to be paretic when actually it is not—or at least was not originally?

If one muscle appears to be paretic and yet is found upon investigation to be normal, attention is then logically turned to the antagonist. The muscles of each eye work in antagonistic pairs. When the agonist contracts, the antagonist must relax and vice versa, according to Sherrington. Most of our thought has been directed at only one half of this problem; namely, that of contraction. If a muscle contracted properly, it was considered to be normal; if not, it was subnormal and therefore paretic.

The other phase—that of relaxation—has seldom been considered except in the same breath with "spasm." Spasm is a nice idea on paper, but even Duane had doubts about it as an individual entity.

Thinking through the relaxation phase of the problem, anyone will readily admit that, if an antagonist is prevented from proper relaxation by any reason whatsoever, the agonist will be prevented from securing the maximum effect from its contraction and will, therefore, appear to be weak or paretic. This would account for an appearance of paresis where no paresis, in the true sense of the word, exists. The important question, then, becomes: "What will prevent a muscle from proper relaxation when its antagonist contracts?"

Recent studies have suggested that many apparently insignificant anatomic anomalies associated with the ocular muscles or their fascial connections, while not preventing in any way the contraction of those muscles or enhancing their mechanical advantage at all, will nevertheless often serve to prevent adequate relaxation of those same muscles during the contraction of their antagonists. This can be easily proved by anyone willing to try the forced duction test.

For example, there is left esotropia and the left lateral rectus appears to be paretic; if, under general anesthesia, one attempts forced abduction of the left eye by depressing a muscle hook in the lateral conjunctival fornix, any resistance to this forced duction can be felt easily via the muscle hook and may even produce noticeable retraction of that eye. If there is only paresis and nothing else, there should be no resistance to forced abduction; there is no such resistance in normal eyes.

On the other hand, any cause acting to prevent adequate relaxation of the medial rectus will serve to produce resistance to the forced abduction. When such resistance to the forced duction test is encountered, surgical exploration of the offending medial rectus will quickly reveal whether the obstacle to adequate relaxation is due to contracture and perhaps fibrosis of the muscle alone or to some anatomic anomaly or to a combination of both.

Frequently, in young patients the muscle in question will be found to be normally elastic and forced abduction of the eye becomes free and easy only when the associated anatomic anomalies are sectioned. Once adequate relaxation is assured in the medial rectus, the lateral rectus can then contract fully and is obviously no longer paretic.

Here is an explanation for the successes of the "weakening" school and for the sometimes remarkable "recovery of tonus" of a "paretic" muscle.

If these same anomalies are not sought, found, and sectioned, they also explain the failures of the "strengthening" school; no matter how much "strengthening" one performs on an apparently paretic muscle, if the fault lies in its antagonist, the "strengthening" procedure is going to be of little or no avail.

It is perfectly logical to attempt to strengthen a truly paretic muscle. It is com-

pletely illogical to direct our fire at a muscle that is "apparently paretic" when in truth the fault lies in the antagonist.

What has been called the "weakening" school is in reality not that at all. It should more accurately be called the school of "removing obstructions to proper relaxation." Removal of such obstacles on an antagonist allows an agonist to contract fully and efficiently and thus to appear to gain strength. The weakening school is really a strengthening school after all. The weakening school gained a majority of their successes in cases of "apparent paresis" while the strengthening school gained theirs in "true paresis."

When secondary changes of contracture and fibrosis have occurred as a result of inadequate relaxation over long periods of time, the two schools step on common ground although many adherents of both refuse to admit it. It would seem that the two schools arose because of a lack of knowledge of the true situation.

As more and more facts are brought to light, it is inevitable that the two schools will lose their identity and merge into a single group of those who are treating causes rather than effects. There are definite indications for the "strengthening" operations and equally definite indications for the so-called "weakening" operations. Neither procedure alone will result in 100 percent of cures and there is no reason to expect that they should.

Richard G. Scobee.

## BOOK REVIEWS

GENERAL CYTOLOGY. By E. D. P. De Robertis, W. W. Nowinski, and Francisco A. Saez. Philadelphia and London, W. B. Saunders Company, 1948. 345 pages, 143 figures, and index. Price, \$5.50.

This book relates knowledge concerning the composition of the cell and, in particular, that knowledge which results from the

application of modern physical methods such as polarization optics, X-ray diffraction, the ultramicroscope, and the electron microscope.

The authors are De Robertis, whose microphotographic records of the path of the poliomyelitis virus along the nerve fibers, made in the department of biology at the Massachusetts Institute of Technology, have been widely publicized; Nowinski of the department of anatomy at the University of Texas Medical School; and Saez of the Institute of Montevideo.

From the first chapter, which presents the history of cytologic knowledge from the discovery of the cell to the new theories of interpretation of cellular structure, through the final chapter, which is on the differentiation, senescence, and death of the cell, the reader is aware that here is a book written by up-to-date authorities in the field of cytology.

Since it is impossible in a short review to discuss the entire text of a volume such as this, I should like to single out Chapter XI, "Visible Manifestations of Cellular Activity," as the one that may well arouse an unusual amount of interest.

In this chapter, ameboid motion is discussed as well as the property of chemotaxis which has great importance in the defense mechanisms of the organism and especially in inflammation, certain substances attracting or repelling cells and so influencing their motion.

Advances in the study of the ultrastructure of the cilia and flagella, and the resultant motion, are reviewed. With polarization optics the cilia and the flagella show a positive intrinsic and form birefringence, which leads to the belief that they are composed of submicroscopic fibrillas orientated along the length of the axis. Direct evidences of this ultrastructure have been obtained with the electron microscope.

Analysis of movement has been facilitated

greatly by ultrarapid cinematomicrography which permits one to follow the various phases in the contraction of a cilium and to calculate the duration of each cycle. One recent theory of the mechanism of ciliary movement is on the basis of changes in water content, the two sides of a cilium being believed to differ in their capacity to absorb water in such a way that the increase in the number of water molecules on one side would cause the cilium to curve toward the opposite side.

The visible manifestations of the nutrition of the cell—as phagocytosis, inclusions, or paraplast—are included in this chapter together with the cytomorphologic aspects of cellular secretion and techniques to study the process of secretion by vital observation (biomicroscopy). In addition, there are fascinating diagrams of the processes of secretion in thyroid and parathyroid glands on which De Robertis has done much original work.

One has but to thumb through this book to understand why it has aroused an unusual amount of interest. It contains a great number of electron micrographs and examples of other forms of microscopy and X-ray diffraction, which are among the finest such pictures ever published.

Interesting and stimulating to anyone who has ever examined a slide under a microscope, the book is particularly excellent for students of medicine and for pathologists, but actually valuable for all who, for the purposes of teaching or investigation, wish to have a general and inspired view of the modern aspects and present-day orientation of cytology.

S. Rodman Irvine.

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MANUAL FOR THE OBJECTIVE EXAMINATION OF THE OCULAR MUSCLE BALANCE. By Beulah Cushman, M.D. Ann Arbor, Michigan, Edwards Brothers, Inc., 1949.



Lithoprinted, 72 pages, references. On sale at the University Bookstore, 434 East Huron Street, Chicago 11, Illinois. Price, \$2.50.

Teachers and students of ophthalmology have long needed a manual of objective examination of the ocular muscle balance. Dr. Cushman has done a good job of it. There are 16 short chapters beginning with the examination of the ocular muscle balance and finishing with suggestions for the surgical correction of squint.

The chapters on amblyopia and its treatment, the near point of convergence, convergence excess and insufficiency, divergence excess and insufficiency, and the value of orthoptics are particularly noteworthy.

Thirty-six cases, chosen from Dr. Cushman's extensive experience, are described in outline detail at the end of the manual and are most instructive. The manual is not intended to supplant the more extensive treatises. It supplements them with an economy of words that is most helpful. It is recommended most heartily.

Derrick Vail.

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**TOXOPLASMOSIS.** A clinical, serological, and histopathological study with special reference to the eye manifestations. By C. D. Binkhorst, M.D. Leiden, Stenfort Kroese, 1948. 163 pages, 14 figures, 3 colored plates, bibliography. Price: Paper bound, \$3.00; cloth bound, \$3.75. (This book may be purchased from the publishers, Breestraat 14, Leiden, Holland.)

Toxoplasma in human tissues has been observed in nearly every country in the world since Laveran discovered toxoplasma protozoa in animals in 1900. In 1911, Janků of Prague found protozoa in the eye of a

hydrocephalic infant. In 1939, Wolf, Cowen, and Paige isolated protozoa from the brain of a child, aged 31 days. Sabin, in 1937, published a work on toxoplasma and since then has been one of the chief workers in this field.

As one of the agents responsible for granulomatous disease in the eye, notably chorioretinitis, toxoplasma has become of grave importance in the determination of the etiology of this disease. Unfortunately, the diagnostic tests that have so far been evolved are either untrustworthy, time consuming, and expensive, or are too difficult for the ordinary laboratory to undertake. The future promises a good deal, however, along this line.

The monograph by Binkhorst is well written and of value. The first part consists of a review of the literature, the epidemiology and properties of the etiologic agent, the diagnosis, ocular manifestations, and treatment. The second part consists of a description of the author's own cases (20) and his observations.

Two of his cases were examined histopathologically. In Case 1, there was a bilateral, chronic, necrotizing retinopathy, with toxoplasma in one of the eyes; the choroid was almost normal. In Case 2, there was one small retinal granuloma.

The question is discussed as to whether the ophthalmoscopic picture is characteristic of toxoplasmosis. Inactive fundus lesions are probably not to be distinguished from chorioretinal atrophy by other causes.

This contribution to our knowledge of toxoplasmosis in ocular disease is timely and welcome, and will help in putting this condition on a firmer basis in the consideration of its importance in chorioretinitis.

Derrick Vail.



# ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

### 1

#### ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Ballantyne, A. J. **The nerve fibre pattern of the human retina.** Tr. Ophth. Soc. U. Kingdom 66:179-190, 1946.

The author reviews earlier work of others and describes the nerve fiber layer of the macular area and temporally. He presents an answer to the unsolved problems of what happens to the fibers of the papillomacular bundle at the margin of the macula and temporally to it and the extent and structure of the raphe. In his investigation the unstained retina was spread face upwards on a glass slide and mounted in glycerin. The composite picture showed that as the radial bundles pass from the disc they gradually spread out more thinly, exchanging fibers from one to the other and showing occasional interspaces. As the nerve fiber bundles approach the periphery they spread apart and the interspaces are wider and are occupied by the feet of Müller's supporting fibers. The raphe is an area from one-half to two millimeters wide within which the nerve fiber bundles assume the form of a network, the

meshes of which are so irregular as to give no indication of the direction or destination of the fibers. The findings explain the form of some retinal lesions but do not reveal the relations of the nerve fibers to the ganglion cell and to other elements of the central area of the retina, nor do they provide an anatomical basis for the phenomenon of the nasal step. (10 figures.) Beulah Cushman.

Loewenstein, A. **Glomus cells in the human choroid.** Nature 163:69, Jan. 8, 1949.

Large round or polyhedral cells of 10 to 20 $\mu$  in diameter are found in the periphery of some choroidal arteries in the posterior pole of many human eyes. They have clear protoplasm, and their nuclei are stained an even dark purple with hematoxylin without visible chromosomes or nucleoli. These so-called glomus or epitheloid muscle cells occur in groups in the media and adventitia of arteries in hypertension and other circulatory disturbance. They serve as cushions by filling the lumen of arteriovenous anastomoses and by shrinking or swelling they may open or close the arteries and veins. They make possible a short circuit from artery

to vein in many normal and morbid processes. It is also conceivable that they are contractile and, constricting certain vessels, help to regulate the choroidal blood circulation and intraocular pressure.

R. Grunfeld.

Wolff, Eugene. **The mucocutaneous junction of the lid margin and the distribution of the tear fluid.** Tr. Ophth. Soc. U. Kingdom 66:291-307, 1946.

The author describes the junction between the skin and conjunctiva as a sharp line on a level with the posterior margin of the openings of the Meibomian glands, just where the lid margin is no longer wetted by the tears. This is confirmed microscopically. The eleiden and keratin layers of the skin end quite sharply and give place to several layers of nonkeratinized squamous epithelium. The number of layers of squamous cells are gradually reduced till at the subtarsal fold the superficial cells become columnar and cubical. In this region goblet cells begin to appear. The oily secretion of the Meibomian glands tends to limit the lacrimal fluid and acts as a low wall round the whole tear reservoir and directs the tears towards the puncta.

A strip of lacrimal fluid is found at the posterior margin of the upper and lower eyelids and the inferior marginal strip runs up on the cornea for a millimeter or so because of surface tension. It is prevented from overflowing by the secretion of the Meibomian glands. A tear lake was found at the outer canthus and the author emphasizes its importance because the lacrimal fluid from the upper conjunctiva may reach the lower conjunctival cul-de-sac through it. The puncta dip into the strips of fluid at the posterior lid margin and in this manner the lacrimal secretion reaches the efferent passages rather than by drainage from the lacus lacrimalis.

Beulah Cushman.

## 2

### GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Dean Guelbenzu, Manuel. **Simple and effective therapy of ocular burns.** Arch. Soc. oftal. hispano-am. 8:1004-1015, Oct., 1948.

Because good results followed treatment of burns of the skin with powdered sodium bicarbonate, the author used it in burns about the eye and found it very satisfactory. He then tried an ointment of sodium bicarbonate in ocular burns, and found its effect very agreeable in acid burns, and of value in caustic burns. In the caustic burns he uses a 4-percent solution of ammonium chloride for the first two or three days, after which sodium bicarbonate was substituted. To explain its favorable action he refers briefly to the work on the physiology of inflammatory processes, by Elkinton, Wolff and Lee, Menkin, Schade, and Fenn and Evans. These investigators demonstrated that the increased permeability incident to an inflammation causes an invasion of the tissues by plasma and its proteins, with a consequent compression of the vessels, and cellular asphyxia. The inflammatory exudate upsets the local acid base equilibrium, with a shift toward acidity; the local anoxia leads to an accumulation of lactic acid, which rises from 19 to 240 percent. Associated with the local acidosis is a marked reduction in the bicarbonate and sodium anions, and an increase of potassium ions. The phagocytic activity requires an alkaline medium and is arrested in a medium with a pH of 5.5. The processes of cicatrization also require an alkaline medium, and are retarded in an acid medium. The beneficial effect of sodium bicarbonate is therefore attributed to its alkalization of the tissues and normalization of the acid base equilibrium, to its effect on absorption of tissue fluids and local an-

oxia, and to its soothing local action on the inflamed tissue. (1 table.)

Ray K. Daily.

Friedenwald, J. S., Buschke, W., Crowell, J., and Hollaender, A. **Effects of ultraviolet irradiation on the corneal epithelium. II. Exposure to monochromatic radiation.** *J. Cell. and Comp. Physiol.* 32:161-174, Oct., 1948.

Experiments on the corneal epithelium of the rat are reported. In this paper the effects of monochromatic ultraviolet radiation of various lengths are noted. In a previous paper (1945) the results of an investigation of the cellular changes following the use of unscreened cold quartz mercury vapor arc were described. The stimulation of mitosis of the corneal epithelium in the cold quartz experiments of 1948 was found to be due to the gas, possibly ozone, that surrounded the generator. When ozone was removed from the exposed area by suction an inhibition of mitosis resulted. Mitosis inhibition, nuclear fragmentation, and loss of tissue cohesion in the corneal epithelium was observed after exposure to monochromatic ultraviolet radiation and sensitivity curves are described. F. M. Crage.

### 3

#### VEGETATIVE PHYSIOLOGY, BIO-CHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Bakker, A. **Carbonic anhydrase and cataracta lentis.** *Brit. J. Ophth.*, 32:910-912, Dec., 1948.

The author discusses the enzyme equilibrium of the lens. By lens culture he has studied the enzyme carbonic anhydrase. As the aqueous does not contain this enzyme, it seems probable that the lens produces its own carbonic anhydrase. The normal lens contains a high amount, lenses with some opacity have considerably less, and mature cataracts none. It was found that the concentration of car-

bonic anhydrase decreased with an increase in cataractous changes.

Orwyn H. Ellis.

von Brücke, H., Hellauer, H. F., and Umrath, K. **The relationship between the acetylcholine and aneurin content and the innervation of the cornea.** *Ophthalmologica* 117:19-35, Jan., 1949.

In 1938 von Brücke discovered the high acetylcholine content of the cornea which became greatly reduced after postganglionic section of the ophthalmic nerve. Now it is found that the epithelium contains nearly all the acetylcholine present in the cornea. After postganglionic section of the ophthalmic nerve, the acetylcholine content increases slightly during the first few hours and then starts to drop; if no keratitis sets in, it drops to about one-half normal. If a neuromyolytic keratitis follows, it varies inversely with the severity of the keratitis. The vitamin B<sub>1</sub> content of the cornea closely parallels the fluctuations in the acetylcholine content. Preganglionic section of the fifth nerve affects the acetylcholine and aneurin content of the cornea only slightly. Cocaine or pontocaine, applied topically, lower the acetylcholine content of the cornea. Topical application of acetylcholine in aqueous solution appears to be beneficial in neuromyolytic keratitis in man. The part played by acetylcholine in the metabolism of the cornea is not definitely known. Peter C. Kronfeld.

Duke-Elder, S., and Davson, H. **Studies on the intra-ocular fluids.** *Brit. J. Ophth.* 33:21-38, Jan., 1949.

In the cat and rabbit, the glucose concentrations in the aqueous humor and vitreous body are lower than would be expected on the basis of a simple diffusion equilibrium with the plasma. Experiments indicate that this deficit of glucose is due to the metabolism of both the lens

and the retina. The possible physiologic significance is discussed and the importance of including the vitreous body in any study of intraocular dynamics is stressed.

Morris Kaplan.

Giardini, A. **The glucose content in normal and in diabetic persons.** *Boll. d'ocul.* 27:585-599, Sept., 1948.

Ninety-eight sugar determinations were performed in specimens of lacrimal fluid taken from 43 individuals with normal glucose metabolism and from 21 diabetics. The Hagedorn-Jensen method was used in spite of the fact that it measures not glucose alone but reducing substances. The results are shown in four tables. Normal tears had a glucose content of 0.02 to 0.28 percent; three subjects had reducing substances in their lacrimal fluid. Repeated examination on the same individual may reveal very different values. One of the diabetics had no reducing substances in his tears, the others 0.04 and 1.20 percent. The author did not succeed in obtaining phenylglucosazone crystals from the lacrimal specimens. Further research with the Nelson-Szomogyi method is contemplated. (Bibliography.)

K. W. Ascher.

Grandjean, E., and Zwahlen, P. **Alterations of the ocular tension and of the retinal arterial pressure at high altitudes.** *Helv. Physiol. et Pharm. Acta.* 6:560-566, 1948.

During a stay at Jungfrauoch (3450 m.) the ocular tension and the brachial and retinal arterial pressure of five healthy subjects were measured daily. The tension dropped after several days at a high altitude which the authors attribute to a general dehydration of the organism. Whereas the brachial arterial pressure dropped at high altitude the retinal arterial pressure rose, which in the opinion of the authors is due to a peripheral vasodilation of the retinal

vessels. This elevation seemingly reflects a parallel circulatory alteration of the cerebral vessels.

R. Grunfeld.

Guimarães, Laertes. **Antibiotics in ophthalmology.** *Arq. brasil. de oftal.* 11:173-198, 1948.

This sixteen-page review of the literature regarding penicillin, tyrothricin, and streptomycin, to which is added a nine-page bibliography, should be of value to readers of the Portuguese language.

W. H. Crisp.

Herrmann, Heinz. **Effect of antihistamines on loss of adhesiveness of corneal epithelium after injection of histamine.** *Proc. Soc. Exper. Biol. and Med.* 69:506-507, Dec., 1948.

Histamine, injected into excised cornea, caused a marked decrease of epithelial adhesiveness. It effected the detachment of the upper layers of the epithelium from the basal ones. The corneas were incubated for 12 to 15 hours at 28 to 30°C. and the adhesiveness of the epithelium was tested with a simple scraper. It was possible to estimate adhesiveness approximately. If antihistamine was injected together with histamine, the anti-histamine protected the epithelium. Several antihistamines are compared quantitatively.

R. Grunfeld.

Hoang-Xuan-Man, and Bailliar, J. **Benzyl-imidazol (priscol) in ophthalmology.** *Ann. d'ocul.* 181:702-723, Nov., 1948.

This drug is a sympathetocotonic peripheral vasodilator of low toxicity which has been employed during the past ten years in Raynaud's disease, angitis obliterans, diabetic gangrene, arterial hypertension and other vascular degenerative diseases. It is used in tablets of 25 mg. for oral use, and in ampules of 10 mg. for retrobulbar injection. In 30 of 40 patients with macular senile and precapillary degenerations improvement

followed one to four injections. Either retrobulbar or oral administration may be employed, but their combined use is apparently more effective. In numerous other ocular degenerative vascular diseases the authors report improvement following the use of prisolol.

Chas. A. Bahn.

Laborne Tavares, Cazimiro. **Antibiotics in ophthalmology.** Rev. brasil. de oftal. 7:53-67, Dec., 1948.

Penicillin, tyrothricin, streptomycin, chloromycetin, garlecin, and to some extent aureomycin are discussed as to forms of administration, and as to organisms against which they are respectively available. As far as possible, preliminary laboratory examination should be utilized to determine the responsible microorganism. Further clinical experimentation is desirable. (References.) W. H. Crisp.

Leopold, I. H., and Steele, W. H. **Choice of sulfonamide drugs for local use.** Arch. Ophthalm. 39:563-578, May, 1948.

Most striking of all factors that influence intraocular penetration of locally applied sulfonamide drugs is the state of the cornea. A great increase in penetration occurs when the cornea is inflamed and partially denuded. Theoretically, it is desirable to have a preparation of the same pH as the tears. If an ointment is desired an ideal vehicle is one that retards epithelial regeneration minimally, is of the oil-in-water type to enhance penetration, and maintain an alkaline pH as an aid in dissociation of the drug, and does not disappear too quickly from the conjunctival sac. Penetration is more rapid from solutions than from ointments. The sodium salt of sulfacetimide (now available in 30 percent concentration) is the drug of choice, because of its low pH and great penetration. Sulfadiazine and sulfapyridine are next best.

Ralph W. Danielson.

McGraw, J. L. **Infection of the cornea due to herpes simplex.** Arch. Ophthalm. 40: 531-552, Nov., 1948.

After a general discussion of the nature of the virus and a review of the literature on treatment of herpes simplex, the authors describe their investigations. Penicillin is ineffective in combating the virus of herpes simplex in mice and in vitro. Streptomycin in high concentration seems to have a slight inhibitory effect on the virus in vivo. Tyrothricin in dilution of 33 mg. per hundred cc. has an unfavorable effect on herpetic infection of the eye of the rabbit. Hyperimmune serum and intravenous use of sodium iodide is ineffective. The local application of 3.5-percent iodine and 70-percent alcohol to herpes-infected eyes of rabbits delays healing and results in greater scarring. Anode iontophoresis of 0.25-percent zinc sulfate is contraindicated in dendritic keratitis in the rabbit but cauterization of dendritic ulcers with 20-percent zinc sulfate is of definite value.

Ralph W. Danielson.

Tschirren, B., and Wiesinger, K. **Investigations concerning the time element of the consensual pupillary reflexes at a high altitude.** Helv. Physiol. et Pharm. Acta 6:554-559, 1948.

The consensual pupillary reflexes of seven healthy men were examined at altitudes 550 m., 800 m., and 3450 m. above sea level. The average latent period is the same as in low altitudes and the average constriction time is considerably smaller in high altitudes. The daily average value of latent period and constriction time diminishes at the beginning of stay at high altitudes but increases after the fifth day.

R. Grunfeld.

Verdaguer, J., and Sielacznik, A. **Use of chamico. (A Datura stramonium.)** Arch. chilenos de oft. 4:457-464, 1947.

This plant is a common weed among



the cultivated crops of Chile. Its pharmaceutical and toxic properties do not differ essentially from those of the Jimson weed of the United States. The author tabulates the results of tests upon the eyes of 550 patients with 12 mydriatics, including chamico, atropine, scopolamine, and homatropine. (References.)

W. H. Crisp.

Wiesinger, K., and Plüss, H. R. **The size of the pupils in high altitudes. Part I. Examination with a photographic method.** *Helv. Physiol. et Pharm. Acta* 6:528-539, 1948.

The size of the pupil of six persons was measured with a photographic method three times daily on 21 consecutive days at 800 and 3450 m. altitude. The diameter became gradually smaller at 800 m. and at an altitude of 3450 m. the pupils became extremely miotic between the third and fifth day and thereafter they gradually enlarged. The oscillations of the pupils, 1 to 2 minutes after illumination change, were smaller at 3450 m. than in the valley.

R. Grunfeld.

Wiesinger K., and Werner H. **The size of the pupils in high altitudes. Part II. Examinations with a double-image pupillometer.** *Helv. Physiol. et Pharm. Acta* 6:540-553, 1948.

The size of the pupils of ten persons was measured twice daily at 560 m. for 9 days, at 3450 m. for 9 days, and at 800 m. for 5 days. The apparatus used for the measurement of the horizontal pupillary diameter consisted of a double refracting Wollaston quartz prism. It was found that at high altitudes the pupils are constricted, the difference of size of the pupillary area in the morning and evening pupil is diminished and the oscillatory pupillary changes are smaller. Fatigue accentuates these findings. As the persons became adapted to the high

altitude, the altitude miosis disappeared altogether.

R. Grunfeld.

#### 4

#### PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Barraquer Cerero, Tomás. **Contact lenses and binocular vision.** *Arch. Soc. oftal. hispano-am.* 8:981-987, Oct., 1948.

Barraquer reports the appearance of convergent strabismus in a high myope, for whom contact lenses were prescribed for cosmetic purposes. The patient wore minus nine spheres in each eye, which corrected the vision of the left eye to normal, and that of the right eye to 6/10. The right eye had a high degree of myopic astigmatism, the correction of which brought its vision to normal. The patient did not have binocular single vision, and used the left eye for monocular fixation. With normal vision in each eye the patient had simultaneous perception, but no fusion, and the right eye turned in. With orthoptic training binocular vision was developed, and the patient was enabled to wear the contact lenses with comfort.

Ray K. Daily.

Birren, J. E., Bick, M. W., and Fox, C. **Age changes in the light threshold of the dark adapted eye.** *J. Gerontology* 3:267-271, Oct., 1948.

Minimum light thresholds determined with the Hecht Schlaer adaptometer on 130 men between the ages of 18 and 83 years showed a significant decline in the subjects over 60 years of age and the most marked changes in those over 70. There was a larger range of individual difference in the older group. The technique is described in detail. The pupils of all subjects over 40 were dilated with 5-percent euphthalmine in order to eliminate miosis. When violet light and white were both used there were similar changes found. There was no significant difference in dark adaptation between



subjects who lived in institutions and those who lived at home (2 tables).

Herman C. Weinberg.

Bischler, V. **Binocular triplopia.** *Ophthalmologica* 116:254-255, Oct.-Nov., 1948.

Postoperative triplopia is a bizarre visual phenomenon resulting from the simultaneous manifestation of anomalous and normal retinal correspondence in certain recently operated cases of squint, first described by Javal in 1864. With the recent developments in the field of binocular sensory co-operation in strabismus, triplopia has become well known. The author describes a typical case. Despite accurate surgical correction of the squint, triplopia has persisted for over a year, the anomalous correspondence maintaining its supremacy. Persistence of the two correspondences may be due to an actual obstacle to fusion which in the author's case was present in the form of a cyclophoria.

Peter C. Kronfeld.

Campbell, D. A. **Primary amblyopia.** *Tr. Ophth. Soc. U. Kingdom* 66:413-428, 1946.

The author separates primary amblyopia from secondary amblyopia which is due to toxic, neurological, psychological and nutritional causes. An error of refraction, particularly anisometropia or bilateral hyperopia, is frequently the primary factor in the onset of suppressive amblyopia. Suppression follows a disturbance of the normal balance of position of the two eyes. The treatment of primary amblyopia should be begun as early as the age of six months by the use of atropine and glasses. Before the age of five years much less time was required to improve the vision than after that age. Longer periods of occlusion were necessary for those patients with vision of 6/60 or less. (5 tables.)

Beulah Cushman.

Cibis, P. **Contribution to the pathology of the adaptation of definite retinal areas.** *Part II.* *Arch. f. Ophth.* 148:216-257, 1948.

The author presents the theoretical background for the data he published in *Arch. f. Ophth.* 148:1-92, 1947 (abstract *Am. J. Ophth.* 31:638, 1948). The reader interested in the explanation of visual phenomena by photochemical processes will consult the original paper. (235 references.)

Ernst Schmerl.

Dartnall, H. J. A. **Visual purple and the photopic luminosity curve.** *Brit. J. Ophth.* 32:793-811, Nov., 1948.

The hypothesis that visual purple is the mediator of photopic luminosity sensations as well as of scotopic is investigated. Two main assumptions are made in developing the hypothesis. The first of these is that the production of visual purple from its precursors is a rapid process in comparison with regeneration from its photoproducts; the second, that the influence of absorption by the photoproducts on the light absorbed by visual purple is equal to that obtaining in a homogenous mixture of the substances.

It is shown that the effect of the accumulation of photoproducts (indicator yellow) in a retina exposed to light, is to move the position of maximum light absorption by visual purple towards the longer wavelengths. This process is not indefinitely prolonged. As the amount of indicator yellow accumulates the light absorbed curve of visual purple rapidly approximates to a limiting position having a maximum at about 550 mμ. When this limiting curve is corrected for absorption by the ocular media and by the macular pigment, the resulting curve closely approximates to the photopic luminosity curve.

Apart from accounting for the Purkinje shift in a quantitative manner the hypothesis provides a basis for the explanation of a number of other visual phe-

nomena, notably the reduced sensitivity of photopic vision and the dependence of the rate of dark adaptation upon the previous light history of the retina.

Author's summary.

Evans, P. J. **Amblyopia.** Tr. Ophth. Soc. U. Kingdom, 66:397-412, 1946.

The amblyopia of congenital nystagmus is due to the movements of the eyes and the duration of fixation is the essential criterion of the level of visual acuity. The suppression is physiologic and not associated with the production of the impaired acuity, but is an essential adaptation to an altered visual mechanism. "Fusion" has little significance in the physiology of binocular vision. The grades of binocular vision are in fact grades of physiologic suppression in a center apart from the striate cortex. Suppression is a normal constant process. These grades account in progressive measures for normal vision, retinal rivalry, the suppression of alternating squint, congenital nystagmus, and amblyopia ex anopsia. (4 tables, 1 figure.)

Beulah Cushman.

Györfy, I., and Kahán, A. **Hyper-sensitivity against contact-lenses.** Orvosok Lapja 42:1337, Oct. 17, 1948.

Antistin-privin prolongs the time of tolerating contact lenses. This is ascribed to the hindering of the effects of histamine set free from the irritated cornea and conjunctiva.

Gyula Lugossy.

Hamburger, F. A. **The refraction of persons with normal vision.** Klin. Monatsbl. f. Augenh. 113:261-266, 1948.

Organically normal eyes may vary in vision as a result of refraction, clarity of media, size of image, the size of cones, and better function of the individual cone. A statistical study of the refraction and vision of the normal eyes of 433 persons, 18 to 22 years of age, is presented. The

vision varied from 6/4 to 6/7. An eye with 6/4 vision may have a 3/4-diopter astigmatism, whereas others with 6/8 may have only a small hyperopic error. Only 367 of the 866 eyes had spheric refraction alone. Almost a third had astigmatism of 0.50 diopters or more. A slight hyperopia is usual. Strict emetropia is the exception and such eyes have a myopia for blue light.

Max Hirschfelder.

Jonkers, G. H. **Dark-adaptation measurements by two different methods.** Ophthalmologica 116:350-356, Dec., 1948.

Recording of the corneoretinal potentials due to the optokinetic nystagmus elicited by horizontally moving pattern of low light intensity can be used for objective adaptometry. In subjective adaptometry the appearance or disappearance of the light stimulus may be used as the criterion. The latter method was developed by Lohmann and seems to give the most accurate values although differences between the two methods are insignificant.

Peter C. Kronfeld.

Kettesy, A. **Pigment-anomaloscopy: a new procedure for testing the colour-sense.** Brit. J. Ophth. 33:47-54, Jan., 1949.

The author has devised an anomaloscope in which one can utilize pigment colors as well as spectral colors. The new instrument consists of a view box containing two cylinders around which are placed detachable papers bearing triangles or parallelograms of any color or shade of color. The subject looks through a slit and shifts the rotating cylinders on their axes until he feels that the colors match. (4 figures.)

Morris Kaplan.

Kettesy, A. **The stabilisation of the refraction and its role in the formation of ametropia.** Brit. J. Ophth. 33:39-47, Jan., 1949.

Steiger's doctrine of the origin of refraction is enlarged with the conception of stabilisation. The latter is the cessation of the growing of the eye, its term varies with individuals, and it is an inherited quality. The cause of the higher degrees of myopia is interpreted as retarded stabilisation. The two weak points of Steiger's doctrine, the excess and the asymmetry of the variation-curve, are explained by the biological peculiarities of stabilisation. Near work has nothing to do with the development of individual myopia, therefore restrictions in the near work of the young myopic patient are unnecessary. Morris Kaplan.

Knüsel, O. **Contact lenses.** *Ophthalmologica* 116:225, Oct.-Nov., 1948.

The author's instrument for taking the exact measurements of the anterior segment consists of multiple levers on a central tube that contains the fixation point. By placing the tips of these levers against the sclera a tracing of the shape of the anterior segment is obtained which should permit the fitting of contact lenses without taking a mold.

Peter C. Kronfeld.

McKellen, G. D. **Conical contact lenses.** *Brit. J. Ophthalm.* 33:120-127, Feb., 1949.

The surface of a conical contact lens must rest on an area sufficiently behind the limbus to avoid pressure far enough from the edge of the lens to prevent the edge from digging into the eye, and it must rest on an area narrow enough to allow change to a new area as the eye moves. The fluorescein test is used to determine the correct angle of cone and the radius of the optic. The band of contact should be 2 or 3 millimeters behind the limbus and give corneal clearance when the eye is in the primary position. Most eyes can be satisfactorily fitted in considerably less time than is required

for other types. The veiling problem does not seem to be appreciably changed.

Orwyn H. Ellis.

Nordenson, J. W. **On the measure of the stereoscopic acuity of vision.** *Brit. J. Ophthalm.* 32:913-914, Dec., 1948.

In a discussion of the measure of stereoscopic vision for adoption of international standards the author reviews the previous reports and states that it seems appropriate to choose for this measure the stereoscopic radius of the examined person. This radius is the quotient of the pupillary distance and the stereoscopic angle of distinction. Orwyn H. Ellis.

Pascal, J. I. **Role of corneal variability in contact lenses.** *Ophthalmologica* 116:318-321, Dec., 1948.

Differences in corneal curvature account for the well-known phenomenon that eyes with widely different amounts of ametropia are corrected with the same contact lens. Peter C. Kronfeld.

Pirenne, M. H. **Independent light detectors in the peripheral retina.** *J. Physiol.* 107:471, Sept. 30, 1948.

In 1945 the author observed that in the periphery the retina possibly was made up of a mosaic of units, each about two degrees in diameter, which, under near-threshold conditions of stimulation, behave as independent light-detectors. When a dim light is flashed over a wide field, only a few detectors among many might be stimulated. Despite this, such a field is not a discretely spotted pattern.

Using dim, constant light flashes (0.03 sec.) as a stimulus in a dark-adapted subject, a field of known area was uniformly illuminated and the light-detection reactions noted to test the above theory. Light detection reactions were noted as correct, incorrect, or absent after repeated light flash stimuli were tried in each case. Francis M. Crage.

Posternak, J. **The visual field at high altitude.** *Helv. Physiol. et Pharm. Acta* 6:524-527, 1948.

The visual fields of six persons were measured for white, yellow, red, and blue at an altitude of 550 m. at Lausanne, and during a ten day stay at the Jungfrauoch, altitude 3450 m. The visual field for white showed no change during the stay at the high altitude. The visual fields for color were not conclusive.

R. Grunfeld.

Posternak, J. **Visual adaptation to darkness at Jungfrauoch.** *Helv. Physiol. et Pharm. Acta.* 6:516-523, 1948.

The authors measured the accommodation to darkness of six persons with a calibrated Engelkind and Harting adaptometer. Measurements were taken first in Lausanne at an altitude of 550 m., then during the course of a ten day stay at the Jungfrauoch, altitude of 3450 m., and then again in Lausanne. The stay at the higher altitude produced a lowering of the threshold which the author attributes not to an acceleration of adaptation but to an increased visual sensitivity.

R. Grunfeld.

Quinn, L. H. **Effect of insulin hypoglycemia on the ciliary muscle.** *Arch. Ophth.* 39:587-594, May, 1948.

Retinoscopic examinations were made before and during therapeutic insulin hypoglycemia. Paredrine hydrobromide ophthalmic, homatropine hydrobromide and atropine sulfate were used to dilate the pupils. Definite stimulation of the ciliary muscle was found in some eyes when paredrine was used as a mydriatic. This was most pronounced in the youngest patients and was greatest during deep insulin hypoglycemia. Homatropine partially abolished the stimulation of the ciliary muscle, and atropine did so almost completely. The fact that the refractive

change which occurs during insulin hypoglycemia can be abolished by atropine cycloplegia indicates that it is due to stimulation of the parasympathetic nervous system. This observation is in agreement with other signs of stimulation of the parasympathetic system, namely, pinpoint pupil, slow heart rate, salivation and increased gastric secretion and motility.

Ralph W. Danielson.

Rios Sasiain, Manuel. **The influence of monochromatic aberration on nocturnal myopia.** *Arch. Soc. oftal. hispano-am.* 8:925-938, Sept., 1948.

The object of this investigation was to determine the effect of spherical aberration on nocturnal myopia. In general, nocturnal myopia is accounted for to a small extent by Purkinje's shift from photopic to scotopic vision, and to a greater extent by changes in the crystalline lens. The effect of pupillary dilatation uncovers the marginal zones of the lens, and that brings about spherical aberration. Earlier investigations on the effect of the size of the pupil on the spherical aberration of the eye are reviewed, and the author's experimental armamentarium is described in detail. The charted and graphic data show that the eye is an over-corrected optic system in which the marginal zones of its refracting surfaces have a greater radius and a lesser curvature. The spherical aberration of the incident marginal rays is neutralized by the diminished curvature of the peripheral zones. Under physiologic conditions the eye has no spherical aberration; it therefore can not be a factor in the phenomenon of nocturnal myopia. Nocturnal myopia is greater with small than with large pupils.

Ray K. Daily.

Romero, Eduardo. **Neutral astigmatism.** *Arch. Soc. oftal. hispano-am.* 8:918-924, Sept., 1948.

Romero contends that all simple cylinders in the trial case should be replaced by crossed cylinders, because each simple cylinder exerts a spherical effect of one-half the strength of the cylinder. In crossed cylinders the spherical component is neutralized, and the effect on the refraction is only in one meridian, which he designates as neutral astigmatism.

Ray K. Daily.

Rubino, A., and Pereyra, L. **The eye and the diencephalon.** *Riv. oto-neuro-oftal.* 23:69-84, March-April, 1948.

Extensive studies lead the writers to conclude that the daily life sense variations are a part of the metabolic and neuro-vegetative manifestation of the mesodiencephalic day-night rhythm. (5 figures, 38 references.)

Melchior Lombardo.

Sloan, L. L., and Wollach, L. **Comparison of tests for red-green color deficiency.** *J. Aviation Med.* 19:447-455, Dec., 1948.

The pseudo-isochromatic plates, anomaloscopic, the Rabkin test are evaluated. (2 figures, 7 tables). Irwin E. Gaynon.

Speiser, S. **The influence of the size of the pupil upon the critical flicker frequency.** *Ophthalmologica* 116:357-370, Dec., 1948.

The phenomenon of flicker is reviewed with special reference to its use as a clinical method of studying retinal function. Dilation of the pupil raises the critical flicker frequency while constriction of the pupil lowers it. These effects are due to variations in the amount of incident light and not to any action of the drugs upon the retina.

Peter C. Kronfeld.

Wagenaar, J. W. **So-called color stereoscopy.** *Ophthalmologica* 117:74-81, Feb., 1949.

Several phenomena of so-called color

stereoscopy, that is, pseudo-plastic effects of flat color-containing patterns, are reviewed. Verhoeff described the optical illusion that the portions of a red line on a black and white background seem to be respectively nearer or farther away and he attributed the phenomenon to the effects of chromatic aberration and eccentricity of the lens system. Loewenstein and Donald observed the following phenomenon and believe that some psychologic factors at present unknown play a great part in producing it. When certain colored patterns are viewed against colored backgrounds for some time, the backgrounds change from surface colors to colored spaces in which the pattern seems to float. The phenomenon was found to be independent of color and almost as striking monocularly as binocularly. Wagenaar explains these and similar phenomena as partly optical, resultant from the superimposition of image and after image in oscillating fixation, and partly psychologic in terms of concepts of "Gestalt" psychology.

Peter C. Kronfeld.

## 5

### DIAGNOSIS AND THERAPY

Alcalá López, Antonio. **A dark room lamp.** *Arch. Soc. oftal. hispano-am.* 8: 946-948, Sept., 1948.

Alcalá describes an inexpensive arrangement consisting of 100 candle-power light globe in a dark housing with a small opening on each side. One serves as a source of illumination for ophthalmoscopy and has attached to it a holder for filters. A blue filter introduced into the holder provides a blue light for the examination of fluorescein-stained corneal defects. The other opening is connected to a tin tube capped with a holder for a condensing lens to focus the light on the cornea for removal of foreign bodies. The lamp is attached to the wall by an adjustable bracket. (1 figure.) Ray K. Daily.



Alcalá López, Antonio. **A model for a box of optotypes.** Arch. Soc. oftal. hispano-am. 8:901-906, Sept., 1948.

Alcalá López designed a new optotype box, with the special objective of discovering simulators, malingerers who hope to escape military service, as well as those who attempt to conceal their visual impairment. The instrument consists of an illuminated box, with a rotating chart on which one letter at a time is exposed. The chart contains letters, Landolt's rings, green and red letters for use with red and green spectacles and targets for estimation of heterophoria. The optotypes are printed on both sides of the paper and can be used directly at 5 meters or reflected in a mirror at 2½ meters. (4 figures.)

Ray K. Daily.

Arentsen, Juan. **Injection of air into the anterior chamber.** Arch. chilenos de oft. 4:485-490, 1947.

The author recommends careful consideration of this detail of technique, as described by Barraquer (Arch. Soc. oftal. hispano-am. April, 1946, abst. Am. J. Ophth., 1947, p. 348) for protection against contact of the iris with the operative wound, and for release of the vitreous from the operative wound in cases complicated by loss of vitreous. The author also speaks very favorably of the measure as applied to filling of the anterior chamber after suture of penetrating corneal wounds.

W. H. Crisp.

Bangerter, A. **Surgical experiences.** Ophthalmologica 116:214-216, Oct.-Nov., 1948.

To dilate the pupil before the intracapsular cataract extraction the author routinely uses homatropine. If this proves insufficient, he injects a small amount of cocaine and epinephrine subconjunctivally. He uses one Liégarde suture and makes two basal iridectomies, one on

each side of the suture. He administers eserine immediately after the delivery of the lens. The patient sits up in bed during the first 24 hours after the operation. Old age or acute dacryocystitis do not contraindicate a dacryocystorhinostomy. Bangerter advocates von Blaskovics' resection and advancement of the levator for most forms of ptosis. The sutures are tied over a metal strip which acts as a splint. Binocular dressing after tenotomy and advancement of the horizontal extrinsic muscles is unnecessary.

Peter C. Kronfeld.

Boles, W. McD. **Combined sodium "pentothal" and local anesthesia for selected cases of eye surgery, with a note on the additional use of curare.** South. M.J. 42:13-18, Jan., 1949.

The use of sodium pentothal is recommended because it does not explode, its use is simple and does not interfere with the operative field. Nausea and vomiting seldom occur postoperatively. There is also a lowering of intraocular tension which is favorable in cases of glaucoma.

Oxygen is advised for the cyanosis which may result from respiratory depression. The use of atropine intravenously prevents the sneezing and coughing that result from the stimulating effect of the sodium pentothal on the parasympathetic nervous system.

Local anesthesia is used to block pain stimuli and curare is added for further muscular relaxation. (1 figure.)

Herman C. Weinberg

Cripps, Mary. **The treatment of traumatic and inflammatory lesions by X rays and ultra-short wave diathermy combined.** Tr. Ophth. Soc. U. Kingdom 66: 333-345, 1946.

Ultra-short wave diathermy was extremely useful in the relief of pain due to mechanical factors such as the increased tension of glaucoma. Irradiation by X rays



alone was invaluable for the relief of nerve pain and prevention of irritation and sympathetic ophthalmia. The combined use of X rays and ultra-short wave in 195 patients caused improvement in various types of inflammatory and traumatic lesions. In 88 cases of acute trauma there was no occurrence of sympathetic ophthalmia. One patient in whom sympathetic ophthalmia had been diagnosed came for treatment 14 days after a penetrating wound with an increase of mononuclear leucocytes, and the attack was aborted. Ultra-short wave diathermy was usually used first to reduce the ocular tension, X rays relieved the pain and deep ciliary injection. A summary of the data is given.

Beulah Cushman.

Davis, F. A. **What the general practitioner should know about ophthalmoscopic examinations.** Post grad. Med. 4:473-500, Dec., 1948.

The author advises a thorough understanding of the structure of the tissues which make up the fundus, some knowledge of the underlying disease processes which manifest themselves in these parts, and painstaking daily use of the ophthalmoscope. He describes the anatomy of the structures of the eye and pathologic changes found in diseases, with many illustrations of different parts of the eye. With accompanied illustrations, he discusses various diseases.

Theodore M. Shapira.

Endt, P. M., and ten Doesschate, J. **A theoretical plan of a method for removing non-ferro-magnetic metallic intra-ocular foreign bodies by means of electro-magnetic forces.** Brit. J. Ophth. 33:97-100, Feb., 1949.

The author presents the theory on which a method for removing non-ferromagnetic metallic intraocular foreign bodies by building up high frequency-electromagnetic fields is based. Copper,

for example, is pushed out of a magnetic field; with its generator behind the head a fragment of copper could theoretically be removed from the eye. A considerable amount of heat is generated in the particle. It is questionable whether a field of sufficient intensity can be produced and the difficulties of heat generation overcome.

Orwyn H. Ellis.

Freusberg, O., and Weigelin, E. **Some sources of error in measuring the diastolic pressure in retinal arteries after Bailliart.** Klin. Monatsbl. f. Augenh. 113:209-220, 1948.

The speed with which the dynamometer is pressed down on the eyeball influences the diastolic pressure only little. The rapid production of pressure tends to give slightly higher values. The very first small pulsations are indicative of the diastolic pressure and to observe them a clear and sharply focused image of the optic disc is imperative. If they escape observation the readings will be too high. Repeated dynamometry tends to lower the intraocular pressure. The proper application of the instrument to the eyeball is important and the authors recommend that one assistant hold the instrument, a second read the scale, while the observer devotes himself fully to the observation of the fundus. Nervousness tends to raise the diastolic retinal pressure by about 4 mm. Hg in health and disease. A second reading after a 15-minute period of rest is suggested. The following routine is recommended: mydriatic, determination of brachial blood pressure, corneal anesthesia, ocular tension, dynamometry, repeated in 15 minutes, brachial pressure, and tension.

Max Hirschfelder.

Giudice, Mario del. **Retrobular saline injections in ocular therapy.** Rev. brasil. de oftal. 7:69-73, Dec., 1948.

Beginning with ulcerative keratitis, the author tried the effect first of subcon-

junctival and then of retrobulbar injections of physiologic salt solution, which he later modified to one-percent solution of sodium chloride. He added one-percent novocain solution because of the pain produced. He gives briefly the details of several cases of inflammatory lesion in which such injections were beneficial. Pain and other inflammatory symptoms were diminished. W. H. Crisp.

Halbron, P., Lepage, F., Leconte, C., and Mawas, H. **Penicillin ophthalmic prophylaxis of the new-born.** *Ann. d'ocul.* 181:676-680, Nov., 1948.

In a series of 2000 births, no cases of gonorrheal conjunctivitis lasting more than 48 hours were observed after penicillin treatment. Two drops of a solution containing 5000 units per cc. were instilled immediately after birth and an ointment with 1000 units per gram was employed later. There were no corneal complications. In 22 infants conjunctivitis due to staphylococcus, streptococcus, pneumococcus, diplobacillus or Kochs-Weeks bacillus was promptly cured by this treatment. Chas. A. Bahn.

Halldén, U. **An instrument for the examination of the central field with binocular fixation.** *Klin. Monatsbl. f. Augenh.* 113:266-267, 1948.

The patient observes a spot of polarized light through polaroid lenses. A screen covered with aluminum paint reflects the spot of polarized light which can only be seen by one eye. The screen itself is diffusely illuminated by unpolarized light and its central fixation point can be observed binocularly. (1 figure.)

Max Hirschfelder.

Huber, A. **The effect of calcium therapy upon the eye.** *Ophthalmologica* 116:235-244, Oct.-Nov., 1948.

The effect of systemic calcium therapy upon the permeability of the blood-aque-

ous barrier was determined by observing the entrance into the aqueous of intravenously injected fluorescein. The rate of entrance of fluorescein into a normal eye is not altered by calcium therapy. In anterior uveitis, congestive glaucomas and ocular injuries the fluorescein method reveals a definite permeability-lowering, "anti-exudative" effect of systemic calcium therapy. Peter C. Kronfeld.

Jacobs, M. L. **Radiation therapy of eye diseases.** *Ann. West. Med. and Surg.* 3:68-69, Feb., 1949.

Inflammatory and non-neoplastic lesions are usually treated with beta radiation and neoplastic lesions with X or Gamma rays. The beta applicator emits rays which do not penetrate more than 2 mm. and are similar to the low voltage or Grenz rays. These have a healing effect on corneal ulcers and are also used for tuberculosis of the anterior segment, corneal scarring, granulation tissue and pterygium. Neoplastic diseases usually respond to X-ray or radium therapy.

Orwyn H. Ellis

Jacot, P. **The treatment of ocular tuberculosis with P501.** *Ophthalmologica* 116:290-292, Oct.-Nov., 1948.

P501, identical with promin, is perhaps the first step in the search for a satisfactory chemotherapeutic drug with specification on the tubercle bacillus. It may prove an adjuvant to streptomycin in ocular tuberculosis.

Peter C. Kronfeld.

Larsson, Harry. **An apparatus for the determination of the axial length of the eyeball.** *Acta Radiol.* 30:237-242, 1948.

The technique and instrument used by the author for the determination of the axial length of the eyeball, essential to the localization of intraorbital foreign bodies, is a modification of the Rushton procedure reported in 1938. The impor-

tance of knowing the exact axial length of the eyeball is apparent when it is realized that this measurement is not the same in all eyes.

Francis M. Crage.

Lauber, H. **The permanent magnet.** Klin. Monstbl. f. Augenh. 110:577-587, 1948.

Adequate electric current for electromagnets was often not available during the war. Permanent hand magnets of an iron-nickel-aluminum mixture proved very successful.

Gertrude S. Hausmann.

Lopez, Enriques M. **Improvement of the "Oculus" ophthalmoscope.** Arch. Soc. oftal. hispano-am. 8:1145-1148, Nov., 1948.

The author describes several modifications for improving the electric ophthalmoscope in use in Spain. They consist of an illuminating handle, which utilizes a nitra lamp of 8 volts and 3.8 amperes, a condensor, and a Rekoss disk provided with diaphragms of two sizes, two slits, and red and red-free filters. (1 figure.)

Ray K. Daily.

Loewenstein, A., and Foster, J. **Fatty embolism of the retinal artery found in eyes after enucleation and orbital exenteration.** Brit. J. Ophth. 32:819-823, Nov., 1948.

Four eyes removed by enucleation and by exenteration were examined internally with the slit lamp after equatorial section of the globe. In each case the central retinal artery was white for some distance from the disc. Serial sections revealed fatty embolism which was more or less fluid and consisted of a fine fatty emulsion which stained a shining red with scarlet red. No red blood cells were found within the milky areas, but distal to the embolism there was the regular column of blood. The presence of the fat is ex-

plained by accidental cutting by the scissors of orbital fat with subsequent sucking of the fat into the artery and its emulsification by the orbital blood. This observation shows the ease with which fatty droplets can enter opened vessels and also a potential danger in foreign body extraction by the posterior route.

Morris Kaplan.

Moron-Salas, Jose. **On gonioscopy.** Arch. Soc. oftal. hispano-am. 8:1108-1113, Nov., 1948.

After a detailed discussion of the optical obstacles to be overcome before seeing the anterior chamber angle, Moron-Salas points out that his contact lens with a deep liquid chamber succeeds in eliminating the astigmatism of oblique rays, which is not achieved by the Goldman or Allen lenses. He admits that Troncoso's valid criticism that a reflected image of the angle loses something of its precision, applies to his lens. However, this is a defect of minor importance, far outweighed by the advantage of being able to do a gonioscopy through the corneal microscope. Ray K. Daily.

Neuenschwander, M. **Placenta therapy of retinitis pigmentosa.** Ophthalmologica 116:262-272, Oct.-Nov., 1948.

In about one-half of 27 patients with far-advanced retinitis pigmentosa who were subjected to tissue therapy after Filatof, results were positive, and at times amazing. In the discussion Bietti sums up his own experiences by saying that therapy with biogenic stimulants must not be considered a complete failure.

Peter C. Kronfeld.

Post, L. T. **Diagnostic significance of failing vision.** J.A.M.A. 139:303-305, Jan. 29, 1949.

This is a brief survey of some of the commoner causes of visual failure, with the note that mutual effort between the

ophthalmologist and practioners of other branches of medicine is very often necessary and of great benefit. The causes of visual failure are listed under the headings cornea, iris, ciliary body and choroid, retina, optic nerve, lens, vitreous, and disuse.

Bennett W. Muir.

Richardson, A. W., Duane, T. D., and Hines, H. M. **Experimental lenticular opacities produced by microwave irradiations.** Arch. Phys. Med. 29:765-768, Dec., 1948.

The authors state that a direct single exposure of rabbit eyes to 12.24 cm.-microwaves at 5 cm. distance for 15 minutes with 100 watts power output resulted in the development of lenticular opacities after 3 to 9 days. After a single exposure the average temperature of the vitreous at the posterior pole of the lens was 55.1°C. and that of the cornea 49.4°C. A series of repeated exposures of a smaller magnitude resulted in lenticular opacities after 2 to 42 days. Four rabbits irradiated for 17 to 20 minutes at 5 cm. distance revealed cataract formations immediately. The practical applications of these microwaves are discussed.

Theodore M. Shapira.

Rintelen, F. **The treatment of blepharospasm with parpanit.** Ophthalmologica 116:217-220, Oct.-Nov., 1948.

Parpanit has proved beneficial in post-encephalitic and arteriosclerotic forms of Parkinson's disease. The author advocates the use of the new drug in cases of idiopathic blepharospasm of older people in whom there is a possibility of an organic, extrapyramidal spastic mechanism.

Peter C. Kronfeld.

Trotter, R. R. and Grant, W. M. **Electronic flash (gas discharge) tube in photography of the anterior segment of the eye.** Arch. Ophth. 40:493-496, Nov., 1948.

For photography of the anterior seg-

ment of the eye, an electronic flash tube of 9,500 lumen seconds' output provides more satisfactory illumination than the illuminants in common use for this purpose. Life-size color pictures can be taken with a desirably small lens aperture, yet with relatively little discomfort to the subject.

Ralph W. Danielson.

## 6

### OCULAR MOTILITY

Bischler, V. **Binocular triplopia.** Ann. d'ocul. 181:724-732, Nov., 1948.

This phenomena is not infrequently observed after operations for nonparalytic strabismus. Diplopia, in this condition, is avoided by suppressing the image of one eye, or by associating an eccentric image of one eye with a centric image of the fixing eye. After a review of several cases reported by Javal, Claasen, Belschowsky, Tschermak, and Cass, the author explains the basic principles involved. Binocular triplopia may be observed from several months to years after strabismus operations. Chas. A. Bahn.

Boldrey, E., and Miller, E. R. **Unilateral paralysis of eye muscles associated with intracranial saccular aneurysms.** California Med. 70:96-98, Feb., 1949.

Congenital saccular aneurysms arise from weak areas in the walls of intracranial arteries where there has been incomplete involution of the embryonal vessels, or from defects at the point of bifurcation of larger intracranial vessels. They arise most frequently from the carotid artery or its principal branches. Three cases are reported in which the diagnosis was made early and treatment by intracranial ligation was successful. Unilateral ocular muscle palsy is an early diagnostic sign.

Orwyn H. Ellis.

Lees, V. T. **A new method of applying the screen test for inter-ocular**

**muscle balance.** Brit. J. Ophth. 33:54-59, Jan., 1949.

The new test employs two Hess screen pointers, perpendicular to each other and similar, which are, however, not red and green and no colored goggles are necessary. Instead, a small plane mirror with a reflecting surface on each side bisects the right angle between the screens. The mirror blocks out the eye not being tested, yet the reflected image of the screen on that side is superimposed on the image of the other screen so that binocular fixation is obtained with monocular vision for the test object. Details of construction of the instrument are described.

Morris Kaplan.

Scheyhing, H. **Tenotomy in convergent squint.** Klin. Monatsbl. f. Augenh. 110: 313-321, May-June, 1944.

Of 134 patients who had been operated on for convergent strabismus in the years 1933 to 1942, 39 had developed divergence. In more than half of them the muscle was completely paralyzed, in the others considerably weakened. In 45 patients without secondary divergence the function of the internal rectus was impaired. The recorded data on all the patients are most thoroughly analyzed and it is obvious that tenotomy with or without a safety suture is an unreliable operation that frequently gives very poor cosmetic results. It should be abandoned in favor of the physiologically more appropriate strengthening of the lateral rectus by shortening and advancement. It is evident from the paper that the fundamental rule to measure the excursions of the eyes before and after the operation was completely neglected.

George Brown.

Tóth, Zoltan. **A new suture in resection of the muscle.** Klin. Monatsbl. f. Augenh., 110:321-324, May-June, 1944.

The muscle is exposed and isolated, cut

at its insertion, pulled forward and two double-armed U-shaped sutures are inserted. One suture enters the distal edge of the conjunctiva, is passed through the muscle as far back as possible, eventually through the insertion and the conjunctiva. The second runs in the opposite direction, through the conjunctiva close to the cornea and muscle insertion, then again through the muscle as far back as possible, and the overlying conjunctiva. One of the sutures should be white, the other black. Finally the muscle is resected and the upper and lower black sutures simultaneously tied to the upper and lower white sutures respectively.

George Brown.

Urrets Zavalía, A. **Abduction in elevation.** Arch. de oft. de Buenos Aires 23: 124-134, April-June, 1948.

Because of the action of the inferior oblique muscles the visual axes tend to diverge when the gaze is directed upward, and conversely they tend to converge when directed downward. This must be recognized in the interpretation of examinations of muscle function. (6 figures, 12 references.)

A. G. Wilde.

## 7

### CONJUNCTIVA, CORNEA, SCLERA

Appelmans, M. **The keratoconjunctivitis sicca of Gougerot-Sjögren.** Arch. d'ophth. 8:577-589, 1948.

Appelmans discusses in detail the historical, clinical, and pathologic features of this syndrome and its relation to the syndrome of Mikulicz. He points out that Gougerot, a prominent French dermatologist, first described the essential features of the syndrome in 1926, before Sjögren's description of it appeared in 1933. Appelmans considers that Mikulicz's disease is a separate entity in spite of the fact that the two syndromes have much in common. He stresses the role of lacrimal dys-



function in the production of filamentous keratitis, which may be a facultative and episodic complication of keratoconjunctivitis sicca. He points out, however, that filamentous keratitis may follow other unrelated conditions such as relapsing keratitis, dendritic keratitis, chronic glaucoma, or herpes zoster.

In discussing the etiology the author considers in turn the avitaminosis theory, the sympathetic dysfunction theory, the neurotoxin theory, and the endocrine dysfunction theory. He suggests the possibility of a chemical mediator, which he calls secretin, which might be concerned in initiating the function of the serous glands. He considers that vasomotor action supplements the chemical action and concludes that the sexual hormones may be concerned with the vasomotor action. He notes that the majority of medications are poorly tolerated in keratoconjunctivitis sicca. Hormonotherapy has been successful early in the disease and closure of the canaliculi has been valuable.

P. Thygeson.

Boulanger, Jacques. **Vitamin D-2 and old tuberculin in tuberculous keratitis.** *L'Union med. du Canada* 77:1439-1441, Dec., 1948.

An alcoholic solution of vitamin D-2 containing 300,000 international units per cc. is recommended as a valuable adjunct to old tuberculin in the treatment of tuberculous interstitial keratitis. Three cases are reported. The dosage recommended is 100 drops three times a week for the first week, 100 drops twice a week for the next three weeks, and 100 drops per week for the following six months. Daily milk and additional calcium are indicated.

Irwin E. Gaynon.

Cometta, F. **The preservation of corneas in liquid paraffin.** *Ophthalmologica* 116:307-310, Oct.-Nov., 1948.

In four of ten keratoplasties done with

donor corneas that were preserved and stored in paraffin oil after the method of Buerki, the grafts remained clear. In one case the donor cornea had remained in paraffin for 42 hours.

Peter C. Kronfeld.

Friede, R. **Keratoplasty for total leucoma. (A case of total sclerosis of the cornea.)** *Klin. Monatsbl. f. Augenh.* 113: 147-152, 1948.

Penetrating keratoplasty has been disappointing in eyes with total and adherent leucoma. Central transplants become opaque and, when too large, develop into a staphyloma. Total replacement of the cornea also is not promising. Friede used a modification of the usual method in eight eyes of which 83 percent healed with opacification, 17 percent were partially opaque, and none remained entirely clear. He tried this procedure in a patient who had a severe sclerosing keratitis with highly inflamed and vascularized corneas. Vision was reduced to recognition of hand movements. A crescentic mass of corneal tissue of one eye was removed down to Descemet's membrane. The defect was filled with a similar shaped donor implant which was held in place by sutures. Six months later a small penetrating keratoplasty was performed in the center of the cornea on the inner curvature of the implanted crescent. This implant stayed clear for several weeks, but got slightly hazy later. In the other eye a large part of the cornea was removed down to Descemet's membrane. The central parts of Descemet's membrane were then removed, leaving a peripheral margin as support for the relatively large donor transplant. The implant became moderately hazy in the following months. The author feels that a large partially penetrating keratoplasty with preservation of Descemet's membrane preparatory to a subsequent smaller total keratoplasty may improve the



outlook for these unfavorable cases of total leucoma. Max Hirschfelder.

Frischer, M., Jablonski, W., and Loebel, M., **The treatment of allergic external diseases in Palestine.** *Ophthalmologica* 116:335-349, Dec., 1948.

Gutmann thinks that vernal conjunctivitis in Palestine is due to an allergy to fungi superimposed on a chronic infection. Specific desensitization and removal of the focus of infection are effective treatment which, however, is too complicated and costly to be used on a large scale. Privine and antistine topically, plus antistine systemically, have given favorable results. Peter C. Kronfeld.

Gorman, J. E. **The Stevens-Johnson syndrome; report of two cases.** *U. S. Nav. M. Bull.* 49:50-54, Jan., 1949.

The author reviews the literature and reports two cases. Orwyn H. Ellis.

Gray, J. D. A. **Meningococcal conjunctivitis.** *Brit. M. J.* pp. 17-18, Jan. 1, 1949.

Purulent conjunctivitis in a 3½-year-old boy healed within eight days under local therapy with 30-percent sodium sulphacetamide, penicillin solution (2,000 units per ml.), and atropine. Meningococcal conjunctivitis is more frequent than is commonly thought; it is erroneously diagnosed as gonococcal. (References.) Bennett W. Muir.

Healy, J. J. **Two cases of exogenous tuberculous conjunctivitis displaying Parinaud's conjunctivo-adenitis syndrome.** *Tr. Ophth. Soc. U. Kingdom*, 66: 455-466, 1946.

Two patients had granulomatous swelling of the upper tarsal conjunctiva which seemed to be a primary exogenous infection by tubercle bacilli, and swelling of the parotid gland on the same side as in typical Parinaud's conjunctivitis. Tubercle

cle bacilli, in one of the human type and in the other bovine, were found in the tissue and in the discharge. Both patients recovered with minimum scarring on general hygienic and local care. No tuberculin was used. Beulah Cushman.

Howell, S. C. and Benton, Curtis, Jr. **Keratitis nummularis (Dimmler); report of five cases.** *South. Med. J.* 42:94-97, Feb., 1949.

In four of five cases both eyes were involved. The disease is usually unilateral. Slitlamp examination showed lesions immediately behind Bowman's membrane, which had dense circular centers and sharply defined edges, surrounded by a less dense halo. These lesions were facets with shallow edges. None of the patients had positive tests for brucellosis. (3 figures.) Bennett W. Muir.

Klainguti, R. **Chestnut bur injuries of the eye.** *Ophthalmologica* 116:247, Oct.-Nov., 1948.

Eye injuries due to chestnut burs are apparently quite common in Switzerland. During harvesting a chestnut may strike the eye and one or several burs may become implanted in the cornea. The protruding portion of the bur usually breaks off, but removal is accomplished quite easily in most cases. Penetration of the tip of a bur into the anterior chamber is rare. Peter C. Kronfeld

Marín Amat, Manuel. **Two cases of fatty degeneration of the cornea, consecutive to corneal herpes.** *Arch. Soc. Oftal. hispano-am.* 8:891-896, Sept., 1948.

One case followed an insignificant corneal injury. Fifteen days after the removal of a corneal foreign body the cornea presented a typical picture of herpetic keratitis, and in spite of therapeutic procedures total fatty degeneration of the cornea, with loss of vision ensued. In the second case there was no

trauma, and three weeks after the onset of corneal herpes the cornea had undergone a complete fatty degeneration. The pathogenesis of fatty corneal degeneration is discussed in detail. The invisible lipoids of the cornea become transformed into visible lipoids through lack of oxidation. The condensation of the fine invisible fatty emulsion in the cellular protoplasm is followed by reaction similar to that of a foreign body in the cells of the reticuloendothelial system; at first the reaction is defensive, but then it proceeds to proliferation of fibroblasts and cicatrization. Inadequate local oxidation is the basic pathologic process, but excessive cholesterol in the diet, disturbances in the lipid metabolism, hereditary predisposition, and vascular disturbances may be important factors. It is suggested that procedures stimulating local oxidation, such as subconjunctival injections of oxygen should be tried in the therapy of these refractory diseases.

Ray K. Daily.

Mitter, S. N. **Scleral degenerations: a case of scleromalacia perforans.** *Brit. J. Ophthalm.* 32:899-904, Dec., 1948.

The author reviews the literature on scleral degenerations briefly and points out their differences. He reports a cystic swelling of the sclera of a young man which extended into the cornea and progressed until the eye became atrophic.

Orwyn H. Ellis.

Motolese, F. **Pseudotrachomatous acute follicular conjunctivitis, due to nonhemolytic streptococcus.** *Boll. d'ocul.* 27:456-463, July, 1948.

Discussing three cases, Motolese revives the famous autoinnoculation experiment performed by Theodor Axenfeld decades ago in order to show the difficult differential diagnosis between conjunctival diseases with follicular formation other than trachoma. Therapeutically he

favors gentle massage of the everted lids with a cotton applicator soaked in mercury bichloride solution. K. W. Ascher.

Orzalesi, F. **One more case of probably herpetic involvement of the corneal endothelium.** *Boll. d'ocul.* 27:424-438, July, 1948.

Orzalesi describes an acute unilateral eye disease in an otherwise normal patient, 50 years of age. It started as an iritis with severe neuralgia of the first branch of the fifth nerve, and later affected the central area of the posterior corneal strata, where intense haziness and pseudoprecipitates were observed. Folding of Descemet's membrane and marked edema of the corneal stroma and epithelium followed. The author classified the disease as Favaloro's kerato-endothelio-Descemetitis and assumed that herpes was the cause. He wonders whether the herpes virus can become localized in the endothelium and on Descemet's membrane as it does in the corneal epithelium and Bowman's membrane and whether a deep herpetic keratitis can originate from a primary invasion by way of the aqueous humor. (3 figures.) K. W. Ascher.

Orzalesi, F. **An unusual type of fatty degeneration of the cornea in a trachomatous eye.** *Boll. d'ocul.* 27:561-584, Sept., 1948.

A 70-year-old man had trachoma with entropion and trichiasis in his only eye and severe scarring of the cornea which was gray with partially protruding yellowish dots. Tension was normal. A corneal transplantation was preformed and the excised disc was examined histologically. The excised disc showed irregularity and increase in layers of the epithelium, the basal cells of which were elongated and rested upon the corneal fibers where the membrane of Bowman had been destroyed; up to 15 rows of

polygonal cells could be counted in some places. There were, however, places where the epithelium was very thin and only one layer of keratinized cells covered the parenchyma. The latter showed severe destruction; many spongy cells like those in xanthomatosis were seen between the ruptured, barely recognizable fibers. Only Descemet's membrane had persisted; its endothelial lining was deficient in many regions. Fat staining revealed the presence of numerous fatty deposits of granular or droplet shape. The pathogenesis of these changes is discussed. (Stereophotograph, 5 photomicrographs, 45 references.)

K. W. Ascher.

Radnót, M. **Posterior progressive scleritis.** *Ophthalmologica* 116:167-171, Sept., 1948.

Radnót reports a case of chronic rheumatoid arthritis and chronic bilateral uveitis of more than ten years' duration. Because of intractable pain, glaucoma, poor light projection and exophthalmos one eye was removed. The histologic examination revealed a noncharacteristic diffuse uveitis and a chronic proliferative scleritis of the posterior half of the sclera which had been greatly thickened and transformed into granulation tissue.

Peter C. Kronfeld.

Sie-Boen-Lian. **Epidemic keratoconjunctivitis in Batavia during 1946 and 1947.** *Ophthalmologica* 116:86-100, Aug., 1948.

An epidemic of epidemic keratoconjunctivitis broke out in Batavia in May, 1946, reached a first peak in November, 1946, and a second one in July, 1947. During the Japanese occupation the author did not see a single case of the disease. He believes it was brought in by the Indian and English army. Indonesians, Chinese and Caucasians appeared to be equally susceptible. The clinical course did not differ significantly from the European or

American form of the disease. The author found systemic sulfathiazole therapy beneficial in that the conjunctival condition usually improved rapidly within five days from the inception of the sulfonamide treatment. The literature is reviewed.

Peter C. Kronfeld.

Sorsby, A., and Ungar, J. **Preliminary note on the treatment of hypopyon ulcer by crystalline penicillin in adrenalin in doses in excess of 50,000 units injected by subconjunctival or retrobulbar routes.** *Brit. J. Ophth.* 32:878-881, Dec., 1948.

The authors found that amounts of penicillin injected subconjunctivally up to 500,000 units at 24 hour intervals were well tolerated, and most hypopyon ulcers responded rapidly and satisfactorily. This is a preliminary report with most promising results thus far. Retrobulbar injections of similar doses appear to be somewhat less efficient, but show clinical response.

Orwyn H. Ellis.

Wolff, J. E. **Ocular complications in erythema exudativum multiforme with mucous membrane lesions.** *Brit. J. Ophth.* 33:110-119, Feb., 1949.

The author reviews the literature of erythema exudativum multiforme, also known as Stevens-Johnson disease and presents two case reports. The etiology is unknown but four causes have been suggested: hematogenous tuberculosis, virus, vitamin deficiency and allergy.

Orwyn H. Ellis.

Zibikowski Margarida, E. **Some details of pterygium surgery.** *Arch. Soc. oftal. hispano-am.* 8:1017-1023, Oct., 1948.

All pterygium operations can be divided into two groups: those in which the raw surface of the sclera is covered completely, and those in which several millimeters of sclera adjacent to the limbus are left exposed. The operation practiced by the author belongs to the latter

group. The cornea is cleared meticulously of every vestige of the pterygium with a knife made of a portion of a razor blade; a flap is then cut away from the lower portion of the pterygium and the remainder is buried under the conjunctiva of the lower fornix. Healthy conjunctiva is thus pulled down from above to cover the space occupied by the pterygium, and an elliptical area of sclera adjacent to the cornea is left exposed. (4 figures.)

Ray K. Daily.

## 8

### UVEA, SYMPATHETIC DISEASE, AQUEOUS

Caballero del Castillo. **Iridodiasis.** Arch. Soc. oftal. hispano-am. 8:897-900, Sept., 1948.

A case of this rare congenital anomaly in a woman, 20 years old, is reported. In the inferior external portion of the iris a hole occupied the outer half and was bridged by some thin iris tissue strands. The pupil was slightly oval, and displaced up and in. This anomaly is the result of imperfect closure of the embryonal cleft. The differential diagnosis between a congenital and an acquired traumatic lesion is discussed in detail, and it is pointed out that Dupuy-Dutemps' statement that in congenital anomalies the pupil is round is not always true. A large congenital deformity may give rise to some distortion of the pupil. (1 figure.)

Ray K. Daily.

Dufour, R. **Ocular manifestations of early pulmonary tuberculosis.** Ophthalmologica 116:298-303, Oct.-Nov., 1948.

In young adults shortly after their first pulmonary infection with tuberculosis, that is during the stage of the primary complex, serous iridocyclitis and retinal periphlebitis took a torpid course, probably because of a low degree of local (ocular) allergy to tuberculin.

Peter C. Kronfeld.

Fleming, Norman. **A case of pigmented leiomyoma of the iris.** Brit. J. Ophth. 32:885-892, Dec., 1948.

The author presents an interesting report of a case of pigmented leiomyoma of the iris, which was completely removed by iridectomy. Section showed spindle cells, palisading of nuclei, and a regular pattern of cell bundles. Myoglia fibers were demonstrated, pigment was present throughout the tumor, and the diagnosis of melanotic neuroectodermal leiomyoma was justified. A review of the other three published cases is given. These tumors are believed to arise from the neural epithelium just as does the dilator muscle. All four published cases have occurred in the lower half of the eye.

Orwyn H. Ellis.

Gómez da Silva, Avelino. **A case of cilium in the anterior chamber.** Arq. brasil. de oftal. 11:153-159, 1948.

In a man of 35 years, examined because of hypertensive retinitis, a cilium lay across the anterior chamber, adhering by its bulbous root to the posterior surface of the iris. There were slight corresponding spots of clouding of the lens capsule and cornea. Removal was not undertaken. (References.)

W. H. Crisp.

Greeves, R. A. **A contribution to the microscopic anatomy of the sympathizing eye.** Brit. J. Ophth. 32:545-550, Sept., 1948.

The history and histologic description of sections of 13 cases of the sympathizing eye in sympathetic ophthalmia are presented briefly. The diagnosis was quite obvious from the history. All patients had had surgery on the other eye. The time of onset after the surgery varied from 5 weeks to 9 years. In seven cases the inflammatory cells were purely lymphocytes and plasma cells, in six cases epithelioid cells were present and in three of these, giant cells were seen. The

only constant factor common to all was the presence of an iridocyclitis which varied considerably in character and intensity. In five eyes the choroid was normal and in 6 there were areas of infiltration with lymphocytes and plasma cells only. The author concludes that no special characteristic of the sympathetic inflammatory process is invariably found in the sympathizing eye.

Morris Kaplan.

Halberg, J. P., and Doret, J. P. **Tuberculosis of the choroid in a case of miliary tuberculosis treated by streptomycine.** *Ann. d'ocul.* 181:485-492, Aug., 1948.

A 16-year-old boy with acute familial pulmonary tuberculosis developed cervical adenopathies with the other classical signs of miliary tuberculosis. During five months he received approximately 250 grams of streptomycine beginning with a dosage of three grams daily which was gradually decreased with the clinical arrest of the disease. During the attack a central choroidal focal lesion was observed in the right eye, and several nodules in the periphery of the fundus of the other. These regressed without anterior uveal involvement and without appreciable loss of sight. The treatment is believed to have favorably influenced healing.

Chas. A. Bahn.

Iñigo, L. **Ophthalmia produced by caterpillar hair.** *Arch. Soc. oftal. hispano-am.* 8:988-1001, Oct., 1948.

Iñigo reports a case of ophthalmia nodosa, in a man, 21 years old, who was struck in the left eye with a caterpillar. A violent inflammatory reaction was set up, and five days later his eye presented a picture of an acute keratoconjunctivitis, with numerous corneal infiltrations. A number of vascularized nodules were also found in the bulbar conjunctiva. With the slitlamp, the lower half of the cornea was found studded with a multitude of

fine needles, some of which were in irregular clumps or bundles. They were lying in the parenchyma either parallel to the epithelium or obliquely, reaching to Descemet's membrane and deeper. An attempt at removal soon demonstrated the futility of the task, because of the deep situation of some of these needles. Under symptomatic treatment the case ran its usual clinical course. It begins with a phase of violent inflammatory signs and symptoms which lasts from five to eight days; this is followed by a second period, in which the inflammatory symptoms subside, vision is recovered, and the cornea acquires a tolerance to the encapsulated foreign bodies; this period lasts about three months. There is, however, always a danger of recurrence of the inflammatory phenomena, with loss of the eye from glaucoma, cyclitis, or retinitis. A detailed description is given of the caterpillar hair and it is demonstrated that the fine needles penetrating the cornea or skin are the contents of a pouch on the dorsal protuberances of the caterpillar, which forms a part of a complicated defense mechanism. The tiny needles are barbed in their posterior portion, which makes their removal difficult after they become imbedded in the tissue. They are propelled deeper into the tissue by ocular movements, by blinking, and by rubbing the eyes. The acute inflammatory phenomena are caused by poison carried by these invading needles. Because of late complications the prognosis should be guarded. Treatment should consist of removal of the invaders, whenever possible; when they are too numerous, mydriatics and lubricating ointments should be used to hasten encapsulation of the foreign bodies at their point of entry. (5 illustrations.) Ray K. Daily.

Klainguti, R. **Circumscribed iris atrophy in Behcet's disease.** *Ophthalmologica* 116:211, Oct.-Nov., 1948.



In a typical case of Behcet's disease (recurrent iritis with hypopyon, associated with recurrent oral aphthae and genital ulcerations) small areas of circumscribed stroma atrophy of the iris developed and increased in size and number as the disease continued to recur.

Peter C. Kronfeld.

McPherson, S. D., Jr. **Sympathetic ophthalmia: a review of 61 cases.** South. M. J. 42:120-124, Feb., 1949.

This is a review of 61 cases of sympathetic ophthalmia observed in the Wilmer Institute in the 10 years that preceded 1948. The shortest interval between injury and onset of the disease was seven days and the longest 23 years; in all but five the disease began after three weeks to one year. Many types of therapy were used but the value of any particular type of treatment is very difficult to assess. In 10 percent the final vision was 20/20 in the sympathizing eye, in 33 percent 20/100 or better, in 46 percent 10/200 or less, and in 5 cases total blindness resulted. It seems wise to reserve enucleation for patients in whom sympathetic ophthalmia has been known to exist in the second eye for one week or less. (5 tables, references.) Bennett W. Muir.

Oxilia, Efisio. **Ocular pathology in Grassi's hereditary elastodystrophy (Cannata's systemic type of dyselastotic mesodermosis).** Ann. di ottal e clin. ocul. 73: 385-427, July, 1947.

Three cases of angioid streaks, two of which were associated with pseudoxanthoma elasticum, are presented and discussed at great length, with particular reference to pathogenesis. The evidence points to a generalized dysembryoplastic mesenchymopathy, that is, a congenital anomaly of development affecting particularly the elastic tissue but also all the connective tissue of the body in general. A choroidal angiopathy may explain the

association of angioid streaks with macular degeneration of the Junius-Kuhnt variety and with peripheral pigmentary disturbances in the retina. Only 13 cases of angioid streaks have been previously reported in Italy, whereas their frequent occurrence has been noted in Anglo-Saxon countries. (2 figures, bibliography 1936-1946.) Harry K. Messenger.

Redi, F. **Senile changes in the choroid, studied histologically.** Boll. d'ocul. 27: 531-547, Aug., 1948.

The eyes from 41 cadavers were studied histologically for senescence of the choroidal tissue. The results are meticulously evaluated and shown in five photomicrographs and in two tables. Thickness and blood vessel content of the choroid decrease with increasing age; the connective tissue of the choroid becomes sclerotic with advancing age and diminishes in extent. Elastic fibers become more numerous throughout life. The decrease in thickness of the choroid is least marked in the vicinity of the ciliary body; the average thickness in the equatorial region and in the posterior polar region is greatest in the 25 to 50-year age group. It was 132 and 170  $\mu$  respectively, whereas in persons younger than 25 years these figures were 119 and 134  $\mu$ , and after the age of 50 years, 97 and 114  $\mu$ . (References.) K. W. Ascher.

Samuels, B. **Participation of the ocular appendages in sympathetic ophthalmia and its bearing on enucleation.** Brit. J. Ophth. 32:569-575, Sept., 1948.

Samuels is convinced that, although sympathetic ophthalmia is primarily a disease of the inner eye, the appendages of the eye may also be involved simultaneously, and after enucleation of the exciting eye these infected appendages are often left in the orbit to spread the disease. He agrees with Parsons that the immediate etiology of sympa-



thetic ophthalmia is a filtrable virus and that this virus enters the eye at the time of the penetrating injury. The virus leaves the inner eye by the same routes as those chosen by the cells of a malignant melanoma of the choroid. It passes through the sclera by way of the numerous emissary veins into Tenon's space. The infection spreads to become a leptomeningitis of the intervaginal space and actually may appear as a collar around the optic nerve. It is certain, however, that the infection is not transferred to the other eye through the optic nerve and chiasm because the opposite nerve never shows signs of descending inflammation. In removing the exciting eye as a preventive measure before any signs of infection have appeared, the ordinary technique may be employed with safety. If, however, the signs of sympathetic ophthalmia are present, enucleation should include resection of the optic nerve and of the inferior oblique muscle as far back as possible and the wound should be left open to drain. If some degree of vision remains in the exciting eye enucleation should be postponed. The benefits of the operation are problematic and sacrificing even the faintest vision is not justified. (5 figures.)

Morris Kaplan.

Snell, A. C. **Postoperative iridocyclitis.** New York State J. Med. 48:2710-2714, Dec., 15, 1948.

Inflammation is produced by the irritants which are liberated from the injured cells. Bacterial toxins and allergic conditions influence the reaction of the tissues. Traumatic iridocyclitis is discussed. Postoperative iridocyclitis is reviewed from the standpoint of the tissue damage caused by the cutting, tearing and crushing which occurs during surgery. Exposed lens cortex is a source of toxic degenerating tissue, and makes possible irritating bacterial products and allergic reactions. Intraocular hemorrhage can

cause iritis after surgery by the liberation of toxic degenerative products and also by the ability of the blood to organize a fibrous tissue. The methods in which a loss of vitreous can cause iridocyclitis are reviewed. (8 figures.)

H. C. Weinberg.

Verhoeff, F. H. **Histological findings in a case of angioid streaks.** Brit. J. Ophth. 32:531-544, Sept., 1948.

The histologic sections of the eye of a 50-year-old patient who died of cardiovascular failure and who had previously been observed to have angioid streaks were studied. Only two deviations from the normal were found. Bruch's membrane was definitely basophilic and there were breaks in it with gaping edges. The change in the staining of the membrane is ascribed to calcification but this calcification must differ from that which is common in senile eyes because in the latter the elasticity of the choroid is absent and there is no gaping of the edges in rupture of the membrane. The ophthalmoscopic appearance of the streak is a result of the visibility of the chorio-capillaris through the break. Three disturbances associated with angioid streaks too often to be merely coincidental are cardiovascular disease, Paget's disease and pseudoxanthoma elasticum. No satisfactory explanation for this association has been suggested. Morris Kaplan.

Verrey, F. **Environmental effects upon intraocular inflammations.** Ophthalmologica 116:204-210, Oct.-Nov., 1948.

A general discussion of some of the factors that influence the course of uveitis by altering the susceptibility of the affected person is presented.

Peter C. Kronfeld.

Weekers, L., and Weekers, R. **Technique of iridencleisis.** Brit. J. Ophth. 32: 904-910, Dec., 1948.

The authors describe a modified iridencleisis. They make a small Graefe incision under a conjunctival flap. The prolapsed iris is torn radially and both pillars are left under the flap. The wound is closed with interrupted sutures. The gonioscopic findings are clearly illustrated.

Orwyn H. Ellis.

Witmer, R. **Cavernous hemangioma of the choroid.** *Ophthalmologica* 116:285-288, Oct.-Nov., 1948.

A bluish-gray, choroidal tumor in a 33-year-old man caused gradual atrophy and later detachment of the overlying retina. Since the tumor slowly increased in size and opaqueness (upon translumination) the eye was enucleated and found to harbor a typical cavernous hemangioma of the choroid. Peter C. Kronfeld.

## 9

### GLAUCOMA AND OCULAR TENSION

Arruda, J. D. **Iridencleisis.** *Arq. brasil. de oftal.* 11:145-151, 1948.

For the Portuguese reader, a brief summary of the history, the classical steps, and some authors' modifications of the operation is given. (References.)

W. H. Crisp.

Barkan, O. **Goniotomy for the relief of congenital glaucoma.** *Brit. J. Ophth.* 32:701-728, Sept., 1948.

In the past this disease has resulted in a high percentage of blindness. Barkan urges earlier and more accurate diagnosis of congenital glaucoma and prompt treatment by goniotomy. He has operated on 76 eyes with satisfactory result in 66. The symptoms of increased intraocular pressure in congenital glaucoma may be present at birth, or their onset may be sudden during the first few months of infancy and consist of cloudy cornea, photophobia and signs of irrita-

tion and congestion. Rarely there is a gradual onset without signs of congestion. Pressure should be measured with a tonometer under ether anesthesia which must be sufficient to assure complete relaxation.

The initial cloudiness of the cornea is associated with roughening of the corneal epithelium and is the chief cause of the irritative symptoms and photophobia. If allowed to persist, it is superseded by permanent scarring with associated irregular astigmatism and amblyopia. Glaucomatous atrophy of the optic nerve is the exception and occurs late. If increased tension is made normal by goniotomy soon after its inception transparency of the cornea is almost completely restored and maintained and vision develops normally. The technique, mode of action, advantages, disadvantages, indications and contraindications of goniotomy are described in detail. (12 figures.)

Morris Kaplan.

Blodi, F. **Nevus flammeus of the face and glaucoma.** *Ophthalmologica* 117:82-89, Feb., 1949.

The clinical findings in two cases of nevus flammeus of the face with unilateral glaucoma but without enlargement of the globe are reported. The second patient had epilepsy and his ailment may, therefore, be a case of Sturge-Weber syndrome. Peter C. Kronfeld.

Brückner, R. **The effect of drugs upon the ocular hypertension produced by Trendelenburg's position.** *Ophthalmologica* 116:200-203, Oct.-Nov., 1948.

A short stay in Trendelenburg's position raises the ocular tension in man and rabbits. The effect upon this ocular tension of various drugs was studied under conditions of topical as well as systemic administration. The author concludes that enhancement of the aqueous drain-

age by way of Schlemm's canal is only one of the factors through which drugs can lower the ocular tension.

Peter C. Kronfeld.

Busacca, A. **Gonioscopic examination of a case of hydropthalmia.** *Ann. d'ocul.* 181:627-628, Oct., 1948.

In a 13-year-old girl with corneas measuring 14 mm., the peripheral areas of the iris were atrophied and the insertion of the iris was displaced by the trabeculum. These changes resulted in a circular goniosynechia, and Schlemm's canal contained blood. The author believes that a vascular communication must have existed between this canal and the conjunctival veins, or the former would have been bloodless from pressure of the contact glass.

Chas. A. Bahn.

Dellaporta, A. **Late infection after filtering operations.** *Ophthalmologica* 116:322-334, Dec., 1948.

Eleven cases of late infection after filtering operations are reported. Nine occurred after trephining, two after sclerectomies after Lagrange. The value of sulfonamides is uncertain since milk injections alone control the infection. Antibiotics were apparently not available. Two eyes became phthisic.

Peter C. Kronfeld.

Desvignes, P., and Naudin. **Nonperforating cyclodiathermy in the treatment of certain glaucomas.** *Arch. d'opht.* 8:589-592, 1948.

The authors have employed nonperforating cyclodiathermy according to the technique of Weekers in the treatment of glaucoma when intraocular surgery was contraindicated. They have used it successfully in cases of secondary glaucoma, in infantile glaucoma, and in chronic simple glaucoma after failure of fistulizing operations. They mention satisfying

results in two cases of traumatic subluxation of the lens with secondary glaucoma. In hemorrhagic glaucoma the results obtained were variable and in absolute glaucoma poor.

The technique consisted of retrobulbar anesthesia followed by applications of the flat electrodes of Coppez to the sclera 5 to 7 mm. from the limbus on the meridians of 12, 3, 6, and 9, eight applications in all. The apparatus is regulated so that a temperature of 90°C. is maintained for 10 seconds. No complications have been observed. The drop in tension is not immediate but gradually develops after a slight and transient rise in pressure. The full effect is not attained until the tenth to fifteenth day. If there is a recurrence of elevated tension, the operation can be repeated. This procedure does not replace the ordinary fistulizing operations but is a valuable supplement to them.

P. Thygeson.

François, J. **Cysts of the ciliary processes observed gonioscopically.** *Ophthalmologica* 116:313-317, Dec., 1948.

For the relief of acute congestive glaucoma an iridencleisis was performed on the only seeing eye of a male patient, 32 years of age. The postoperative course was uncomplicated and a filtering scar developed. The ocular tension has remained below 25 mm. Hg Schiøtz for four years. Gonioscopic examination of the area of the operation reveals the inner aperture of the operative wound to be tightly healed. In the pseudocoloboma created by the meridional iridotomy a number of ciliary processes are plainly visible. Two small cysts are situated between the processes. The contents, as well as the major portion of the wall of the cysts, are colorless.

In the author's experience the inner aperture of the iridencleisis wound is always completely closed, without the

slightest dehiscence between the wound lips. The incarcerated iris functions as a drain. The existence of a filtering scar is not necessary for a tension-lowering effect of the iridencleisis. The latter is chiefly due to a modification of the fluid exchange and of the metabolism in the iris and in the ciliary body.

Peter C. Kronfeld.

Goldmann, H. **Outflow pressure and glass-rod phenomenon.** *Ophthalmologica* 116:195-198, Oct.-Nov., 1948.

Pressure exerted on the eyeball by means of an instrument like the Souter tonometer placed against the center of the cornea, increases the intraocular pressure and modifies the circulatory conditions in the aqueous veins. The smallest amount of pressure thus exerted which causes a noticeable widening of an aqueous vein is called outflow pressure. This pressure is related to the resistance which the aqueous encounters during its passage from the anterior chamber to the anterior ciliary veins, and to the amount of aqueous passing through these channels. The fact that in wide-angle glaucoma Ascher's glass-rod phenomenon is nearly always negative indicates that in this disease the pressure in the canal of Schlemm is relatively low. The outflow pressure, however, is definitely increased. Goldmann concludes that the resistance between anterior chamber and canal of Schlemm is abnormally great in chronic simple (wide-angle) glaucoma.

Peter C. Kronfeld.

Grant, W. M. **Miotic and antiglaucomatous activity of tetraethyl pyrophosphate in human eyes.** *Arch. Ophth.* 39:579-586, May, 1948.

Tetraethyl pyrophosphate is comparable to physostigmine and di-isopropyl fluorophosphate in miotic activity and may be used when there is local sensitivity to other miotics. In several instances,

0.05 to 0.1-percent solution of the drug in peanut oil used twice a day was more effective than 4 percent pilocarpine nitrate used more often. An excessive dose may cause aching about the eye, and in certain eyes an increase in tension occurred. The drug acts as an inhibitor of cholinesterases. Ralph W. Danielson.

Kapuscinski, W. J. **Contribution to the clinical study of glaucoma.** *Ann. d'ocul.* 181:542-555, Sept., 1948.

In approximately 40 patients the usual provocative tests for glaucoma were of little practical value. Diminished light adaptation is of greater value diagnostically. Several case histories of juvenile glaucoma are presented to illustrate that miotics such as pilocarpine may increase ocular tension and that atropine may lower tension. The characteristic disk excavation as well as central and peripheral visual changes of glaucoma are not infrequently associated with normal tension as is illustrated by several case reports. No single theory yet presented explains all the objective symptoms of the juvenile type, nor the acute and chronic primary types of glaucomas in adults.

Chas. A. Bahn.

Di Luca, G. **Biomicroscopic examination of the cicatrices of antiglaucomatous operations.** *Rassegna ital. d'ottal.* 17:304-317, Sept.-Oct., 1948.

Di Luca bases an explanation of the mechanism of action in successful surgery in glaucoma on the postoperative biomicroscopic examination of 23 eyes and a study of the literature. Anastomosed collateral circulation develops across the area of operation for the normalization of tension. These subconjunctival vessels unite with the uveal vessels to supplement the outflow of fluid from the globe. (7 figures.)

Eugene M. Blake.

Majoros, J. **Postmortem ocular pressure.** Arch. Ophth. 39:665-668, May, 1948.

The ocular pressure falls at the moment of death, but some pressure remains. In numerous ophthalmic and general diseases the pressure is sometimes as low as it is in death. The glaucomatous eye retains its pressure after death and after enucleation. Ralph W. Danielson.

Monfette, Claude. **Treatment of chronic glaucoma with nicotinic acid.** L'Union med. du Canada 77:1433-1435, Dec., 1948.

The author states that glaucoma is a diencephalic affection, a dysfunction of the thalamus and hypothalamus with vasomotor predominance involving the capillary circulation in which there is localized edema and an increase of blood and interstitial fluids in the eyeball.

Nicotinic acid is used in a concentration that will not impair the choroidal circulation. A test dose of 2 mgm. is given intravenously. The vision and tension are taken every 15 minutes for one hour. If the reaction is favorable, the recommended dose is 1 mgm. in distilled water twice a day by mouth. It is not indicated in acute glaucoma, secondary glaucoma with anterior segment lesions, hemorrhagic glaucoma, old chronic glaucoma, and when the tension is above 50.

Irwin E. Gaynon.

Much, V. **Contributions to the surgical treatment of glaucoma.** Ophthalmologica 117:36-42, Jan., 1949.

The author reports in considerable detail a case of bilateral chronic noncongestive glaucoma for the relief of which a sclerectomy after Lagrange was performed on the right eye and a cyclodialysis on the left eye. Although neither operation accomplished normalization of the tension the operations may be considered as successful. The tensions of the cyclodialyzed eye were, in general, higher than

those of the other; and a better visual field was preserved. The lowering of tension is not the only beneficial result of surgery. Peter C. Kronfeld.

Posner, A., and Schlossman, A. **Treatment of glaucoma associated with iridocyclitis.** J.A.M.A. 139:82-86, Jan. 8, 1949.

The use of mild miotics in combination with phenylephrine hydrochloride ("neosynephrine hydrochloride") is advocated for the syndrome of glaucomatocyclitic crises and for other conditions in which posterior synechiae are not formed. It seems more effective than for secondary glaucoma. Theodore M. Shapira.

Posner, A., and Schlossman, A. **Development of changes in visual fields with glaucoma.** Arch. Ophth. 39:623-639, May, 1948.

Approximately 2,000 visual fields in 350 cases of primary glaucoma were studied and classified. The development of the characteristic field changes was analyzed by breaking down these defects into their component units, namely, the arcuate scotoma, the nasal field defect and the juxta-ecial step. A relationship exists between the circulatory and the neural elements of the glaucomatous field and most defects result from a mixture of these two components. The authors feel that damage to nerve fibers at the margins of the cup and by traction from the receding lamina cribrosa is not of greatest importance. Ralph W. Danielson.

Radnót, M. and Németh, B. **The eye first affected in glaucoma.** Ophthalmologica 117:60-62, Jan., 1949.

The records of 902 patients with glaucoma show that either eye may be affected first, whereas Holst found the left eye involved more often.

Peter C. Kronfeld.



Schmelzer, Hans. **Investigations of glaucoma in the present war.** *Klin. Monatsbl. f. Augenh.* 110:289-296, May-June, 1944.

Before the war the author had found a hypercholesteremia, a positive xantho-protein reaction, frequently an increased bilirubin index in the blood-serum and a disturbance of the liver function in the majority of his patients with glaucoma. During the war the blood cholesterol was decreased because of restriction in fat, alcohol and coffee. Thus the war imposed a "liver-saving diet" on patients with glaucoma. Twenty-one patients with glaucoma who had had an average blood cholesterol of 273 mg. percent before the war were re-examined. The average blood cholesterol was 202 mg. percent and there was no progress of the glaucoma, except in three patients. In two of the latter, well nourished farmers, the tension was high, visual fields and central vision had become worse and the blood findings were the same as before the war.

George Brown.

Silva, M. A. da. **Iridencleisis.** *Arq. brasil de oftal.*, 11:122-132, 1948.

The technique of the Holth operation is described for the reader of Portuguese with a tabular statement of the results obtained in series of cases of trephining, cyclodialysis, and iridencleisis respectively. Iridencleisis is as yet very little used in Brazil. (6 figures.)

W. H. Crisp.

Stocker, F. W. **New ways of influencing intraocular pressure.** *New York State J. Med.* 49:58-63, Jan. 1, 1949.

The principles upon which glaucoma is treated by miosis or surgery are reviewed.

Of 32 negroes who had been treated by cyclodiathermy puncture twenty had normal pressures almost three years later, seven were improved and five were not improved. The place of Etamon and Pris-

col and their paralyzing effects on the autonomic nervous system in causing lowered ocular tension is discussed. The use of the rice diet met with some success in reducing ocular tension under certain circumstances. Rutin was used to prevent the increase in permeability of the blood-aqueous barrier which occurs after the use of miotics. The increased outflow of aqueous produced by miosis is often nullified by this increased permeability of the blood-aqueous barrier. Twenty-six patients were given 20 mg. of rutin three times a day; there was improvement in 17, no improvement in 5 and questionable improvement in 4. The author recommends dosage up to 50 mg. of rutin three times a day. (4 figures, 3 tables.)

H. C. Weinberg.

Vidal, F., Brodsky M., and Travi, O. C. **Dynamic ocular tone and metabolic disturbances.** *Arch. de oft. de Buenos Aires* 23:92-93, April-June, 1948.

The elevation of tension is but a stage in the evolution of glaucoma, and is primarily dependent on changes in the metabolism of the various ocular tissues. The abnormal alterations are made manifest by asthenopia, headaches, diminution in the sensitivity to light, and visual clouding and result from increased cholestrinase in the retina, emotional upsets, infections, and abrupt alterations of temperature.

A. G. Wilde.

Villaseca, Alfredo. **Nonperforating cyclodiathermy in the treatment of glaucoma.** *Arch. chilenos de oft.* 4:425-456, 1947.

The author begins this 32-page paper by urging emphatically that recent studies have deposed the idea that the fundamental change in glaucoma occurs at the angle of the anterior chamber. He uses an electric needle whose head is perfectly flat and 1.75 mm. in diameter. After dis-



section of conjunctival and subconjunctival tissue, the exposed sclera must be rendered perfectly dry and free from blood. Each application is made for five seconds only, using firm pressure (Albaugh and Dunphy recommend 8 to 10 seconds). The intensity of current considered adequate is such as to cause first retraction and then a "parchment-like" effect in the sclera for 0.5 to 1 mm. around the electrode. The applications are made over a quadrant or more and as far back as 5 to 6 mm. from the limbus when the previous tension was below 35 to 40 mm., and up to one half of the circumference if the tension was above 40 to 50 mm. There should be a frank rise of ocular tension at the end of the operation. If there is no appreciable rise of tension at that time, some of the applications should be intensified or additional applications made. The eyeball is painful for 24 hours, more or less.

In 17 of the author's 30 cases the tension was reduced to normal by diathermy. Further deterioration of vision or visual field was not produced. However, there was a definite corneal anesthesia in the sector operated upon. Usually this did not have major consequences, but in two patients serious trophic changes occurred. Once or twice the tendency of the eye to atrophy was accelerated. The author regards this as the operation of choice in hemorrhagic glaucoma, in painful ab-absolute glaucoma, and in rubeosis of the iris; and it was also serviceable in the chronically glaucomatous aphakic eye, in advanced simple chronic glaucoma with greatly restricted visual field, in posterior luxation of the lens, in glaucoma of aniridia, and in buphthalmos. (Tabular summary; references.) W. H. Crisp.

Weekers, L. and Weekers, R. **Non-perforating thermometric cyclodiathermy in treatment of hypertensive uveitis.** Arch. Ophth. 40:509-517, Nov., 1948.

The diathermy apparatus, thermometer circuit and technique of operation are described; 12 to 16 coagulations 8 mm. from the limbus are made through the conjunctiva. The operation is similar to that of Albaugh and Dunphy, but differs in that the Weekers do not regard dissection of the conjunctiva as necessary, they do not limit themselves to one-half the circumference of the ciliary body because previous experimental researches have demonstrated that when the operation is performed in a small territory it becomes necessary to use a more intense diathermy current to obtain a sufficient effect on the ocular pressure, and use a thermometer electrode, which enables them to regulate their intervention and to repeat it under identical conditions. The authors used to practice iridencleisis ab externo in the treatment of ocular hypertension with uveitis, but now prefer non-perforating cyclodiathermy. The main indications for thermometric nonperforating cyclodiathermy are uveitis complicated by intraocular hypertension, hypertension persisting after a filtering operation, painful absolute glaucoma, and intraocular hypertension after corneal transplantation. Ralph W. Danielson.

Weekers, L., Weekers, R., and Rousel, F. **The mode of action of the non-perforating cyclodiathermy.** Ophthalmologica 117:65-73, Feb., 1949.

A flat round electrode, 0.75 mm. in diameter, at 90°C. is applied to the sclera 7 mm. from the limbus for 15 seconds in 20 areas. On patients with chronic primary or iridocyclitic glaucoma operated by this method the author studied the pupillary responses to the topical application of drugs. Since the cyclodiathermy injures the ciliary nerves, parasympathetic and sympathetic denervation is expected. The irides of these patients proved highly sensitive to mechoyl and epinephrine and insensitive to cocaine.

The response to eserine was equivocal. The authors conclude that their operation causes extensive denervation of the anterior uvea. The resulting permanent loss of the vasoconstrictor control causes alterations in the fluid exchange of the eye.  
Peter C. Kronfeld.

## 10

## CRYSTALLINE LENS

Andradee, Lopes de. **The intracapsular cataract extraction.** *Ophth. Soc. U. Kingdom* 66:241-245, 1946.

The author has tried to simplify the operative procedure by opening the eyelids with stitches and fixing the eyeball by means of sutures passed through the superior, inferior and internal rectus muscles.  
Beulah Cushman.

Comberg, W. **Surgery of unilateral cataract.** *Klin. Monatsbl. f. Augenh.* 110: 340-343, May-June, 1944.

The peripheral vision of an aphakic eye without correcting lens is about one-third normal 25 degrees eccentrically, and about two-thirds at 55 degrees. The extraction of a unilateral cataract seems indicated because of the considerable gain in visual field even though optical correction is not tolerated. The total disability is not more than 10 to 15 percent.

George Brown.

Crámer, F. E. K., and Foglia, V. G. **Experimental diabetic cataracts in rats.** *Arch. de oft. de Buenos Aires* 23:101-117, April-June, 1948.

Extirpation of 95 percent of the pancreas will regularly produce cataract in the rat in a minimum of seventy days. The major changes are in the cortex.

A. G. Wilde.

Csillag, F. **Loop extraction of subluxated cataracts.** *Ophthalmologica* 116:172-176, Sept., 1948.

Attempts to grasp the lens capsule with a smooth capsule forceps may fail because of defectiveness of the zonule, hypertension within the lens and its capsule, and fluidity of the lens cortex. When the zonule is defective the author recommends extraction with a modified loop which is introduced into the anterior chamber in front of the lens and applied like a lasso to the portion of the equator opposite the incision. When the defect is in the lower part but the upper is intact the incision is made above, as usual, and after a total iridectomy the loop is carefully slipped into the anterior chamber and around the lower part of the equator of the lens. Once this has been accomplished the extraction of the lens is easy.

When there is hypertension in the lens, or the cortex is fluid the author recommends needle puncture of the lens near the equator above.

Peter C. Kronfeld.

Fanta, H. **Rupture of the wound following cataract operation.** *Ophthalmological* 116:149-161, Sept., 1948.

This report from Lindner's clinic in Vienna stresses the value of corneoscleral sutures which "proved a sure protection against ruptures of the cataract incision, even during the bombing of the city." In the routine technique of intracapsular cataract extraction at Lindner's clinic a small limbus-based flap is prepared and one de Mendoza (McLean) suture is placed in the corneosclera at 12 o'clock. After an incision with the Graefe knife a sliding forceps extraction is performed by means of an Arruga forceps applied just anteriorly to the upper equator. The suture is tied and two peripheral iridectomies are made, one on each side of the suture. Hilding's experimental work (*American Journal of Ophthalmology* 28:871, 1945) is quoted in detail and corroborated by clinical observations.  
Peter C. Kronfeld.

Franceschetti, A. **Cataract operation on an eye with sympathetic ophthalmia.** *Ann. d'ocul.* **181**:530-534, Sept., 1948.

A successful cataract extraction was performed on a woman, aged 25 years, who, 12 years previously, had sympathetic ophthalmia. The injured eye was removed nine weeks after an injury from a dart. The sympathizing eye which had long been inactive had good light projection. A keratome incision was followed by iridectomy, detachment of synechia, and lens extraction with a spoon. The ultimate corrected vision was 0.3. A brief survey of the literature follows.

Chas. A. Bahn.

Franceschetti, A. **Successful cataract extraction from an eye with sympathetic ophthalmia.** *Ophthalmologica* **116**:213, Oct.-Nov., 1948.

The author reports the case of a young woman who at the age of three years sustained a perforating injury to her right eye. Nine weeks later the left eye developed sympathetic ophthalmia which took a prolonged and severe course, in spite of the enucleation of the injured eye (time of enucleation not stated). When the patient was 13 years old, two iridectomies were attempted but accomplished only partial removal of iris stroma. The posterior layers of the iris could not be lifted up with forceps. Several years later the uveitis appeared inactive, the cornea had undergone band-shaped degeneration, there was seclusion of the pupil and a complicated cataract. The patient was operated on again. The author succeeded in making an iridectomy. Through the coloboma he introduced a spatula and broke most of the posterior synechiae. The lens was delivered with a loop. Three years later the patient's corrected vision was 0.3 and the eye was quiet.

Peter C. Kronfeld.

Giri, D. V. **Technique of intracapsular extraction of cataract with retention of**

**conjunctival bridge.** *Tr. Ophth. Soc. U. Kingdom* **66**:247-260, 1946.

The author advised the use of nembatal and of liberal local anesthetics, and atropine and adrenalin for dilatation of the pupil, but no retrobulbar injection. A conjunctival bridge is made at the time of the corneal section, with or without an iridectomy. The lens can usually be removed in its capsule. (5 figures.)

Beulah Cushman.

Holland, H., and Holland, R. W. B. **Notes on 221 intracapsular cataract extractions performed in three weeks at Khairpur in 1947.** *Brit J. Ophth.* **33**:101-106, Feb., 1949.

The author performed these intracapsular extractions by the Smith method which is recommended only for experienced surgeons. Only two cases of retinal detachment have been observed in over 30,000 intracapsular extractions at this center. If the upper pole of the lens does not present immediately after the beginning of the delivery, the lens is extracted extracapsularly.

Orwyn H. Ellis.

Hruby, K. **Simplified corneoscleral suture in cataract extraction.** *Wien. klin. Wchnschr.* **60**:748-749, Nov. 19, 1948.

Hruby describes his modification of the Mendoza suture as practiced by Lindner and claims for it the advantages of the firm wound closure that Lindner's technique gives and much less technical difficulty. After preparation of the conjunctival flap he makes two short superficial incisions, instead of one, in the outer sclera to receive the suture, one at the limbus, the other 1 to 2 mm. behind it. There is ample room for the cataract knife between them and it rarely cuts the suture, an accident which is relatively frequent with Lindner's operation. In 252 cataract operations this accident occurred only twice, whereas with Lindner's technique in 95 operations the su-

ture was cut 11 times. A detailed description of the operative procedure is given. (1 figure.) B. T. Haessler.

Kirby, D. B. **The rupture of the zonule in intra-capsular cataract extraction—a new method.** *Brit. J. Ophthalm.* 33:3-21, Jan., 1949.

The rupture of the zonula fibers is essential in the intracapsular extraction of the lens and the finding of many resistant zonules is accounted for by the number of immature cataracts extracted. The point of rupture of the fiber is just at its junction with the capsule which accounts for the absence of retinal separation. A common error of judgement is to attempt to rupture all zonules by the same method instead of adapting a suitable method to each eye. For rupturing the fibers indirectly, Kirby prefers a combination of the three methods, pressure from without, traction on the capsule, and rotation of the lens in the capsule. After making the section, he uses enough pressure on a point within the corneal limbus at the 6, 8 and 4-o'clock positions to indent the cornea 2 to 3 mm. and to make the wound gape. Pressure outside the limbus is unnecessary, ineffectual and dangerous. Almost simultaneously with the point pressure and while the wound is gaping, the capsule forceps is applied to the anterior capsule just below the equator. He much prefers the forceps to the loop, the pointed hook, the electro-coagulation electrode and the various types of erisiphakes. Kirby describes his new forceps which is a combination of the Kalt, Arruga and Verhoeff forceps and has a cylindrical handle. His traction is actually a rotation from side to side and he often uses two forceps rather than one. Direct rupture of the zonule is indicated when the zonule is unduly resilient, when patient and surgeon are both relaxed, and when the zonule can be made tense by elevating the lens at least 3 mm. He has

used direct rupture for 10 years with excellent results. (7 figures.)

Morris Kaplan.

Knapp, Arnold. (Bowman Lecture.) **The present state of the intracapsular cataract operation.** *Tr. Ophthalm. Soc. U. Kingdom* 66:133-178, 1946.

The history of intracapsular cataract surgery is reviewed from 1903 when Henry Smith developed the intracapsular technique in India to the present time.

Three features of the anatomy of the zonule are important in the understanding of the technique of the intracapsular extraction; they are the origin of the fibers, the independence of the zonular membrane from the hyaloid part of the vitreous, and the insertion of the zonular fibers in the lense capsule. The knowledge of the slight variation in the thickness of different parts of the lens capsule and of the consistency of the lens makes it possible to decide where the capsule should be grasped. The lens can usually be more easily dislodged tangentially, but the thickness, tenseness and elasticity of the lens capsule are important. The older the patient (usually over 60 years of age) the easier the subluxation, and intracapsular extraction is not suitable in persons under 45 years of age.

Smith brings about subluxation of the lens by pressure straight back on the lower half of the cornea, which causes the head to present, and pressure downward on the lowest peripheral point causes the lens to somersault. A slight turning of the lens around in the transverse axis aids in breaking the zonular fibers. The suction cup devised by Halen and popularised by Barraquer also turns the lens on the transverse axis. Verhoeff subluxates by torsion and traction. Kalt introduced the use of capsular forceps and now the use of different types of forceps with some counter pressure is almost universal. The capsule forceps

must be small and firm, the speculum light in weight and easily removable with one hand. Akinesia and retrobulbar injection which temporarily weakens the extraocular muscles, especially the inferior rectus, simplify the operation. The use of corneoscleral sutures ensures a quick restoration of the anterior chamber. There should be no traction of the flap and no constriction of the tissues. The injection of air into the anterior chamber counteracts any tendency to anterior adhesion of the hyaloid membrane or of the iris.

The complications of intracapsular operation depend on the proper selection of the cataract. The intumescent cataract with swollen cortex is tense and most difficult to hold with blunt forceps; in its removal the suction procedure is helpful. Many nuclear cataracts, posterior cortical cataracts and sclerosed lenses are the most favorable for the intracapsular procedure. The loss of vitreous is the most important complication and may occur directly after the incision, during subluxation or after delivery of the lens. The loss of vitreous or injury to it is often followed by a pupil which is drawn up because of cicatricial contraction of the vitreous and adhesions of the iris. Rupture of the capsule during extraction of the cataract may be serious if the hyaloid membrane is also ruptured. Iridocyclitis occurs after intracapsular extractions but is usually very mild. In the more severe types it may be followed by deep vascularization of the cornea and glaucoma. Glaucoma is usually secondary to anterior adhesions of the capsule to the incision or it may follow an anterior adhesion of the hyaloid membrane to the posterior surface of the cornea or to the incision. Trauma to the corneal endothelium may cause the hyaloid membrane or iris to become adherent before the anterior chamber is established. The injection of air or salt solution into the anterior chamber at the close of the operation will help

prevent an anterior adhesion of the vitreous body. Detachment of the retina usually seems to be associated with low grade cyclitis. Complications of the intracapsular operation are difficult to treat satisfactorily. The future of the operation lies in the reduction of the difficulties by improvement in the methods of operating.  
Beulah Cushman.

Knüsel, O. **Two cases of electric cataract.** *Ophthalmologica* 116:212, Oct.-Nov., 1948.

In the two cases reported the electric shock consisted of very brief exposures to electric current (8,000 to 11,000 volts). The lens opacities which had remained almost stationary for several years, apparently were the only permanent residue of the electric shock. The latent period of electric cataract is stressed.

Peter C. Kronfeld.

Loutfallah, M. **Bilateral detachment of the retina in aphakia.** *Eye, Ear, Nose and Throat Monthly* 28:73-75, Feb., 1949.

The author reports an interesting detailed case report of bilateral detachment of the retina successfully operated upon with scleral diathermy. The lenses had been removed six and nine years previously, extracapsularly and without dissection. The literature is reviewed.

Orwyn H. Ellis.

Samuels, Bernard. **Proliferation of the epithelium of the lens.** *Tr. Ophth. Soc. U. Kingdom* 66:467-491, 1946.

The author summarizes the proliferation of the epithelial cells of the lens in 185 cases of nontraumatic cataract. The greatest proliferation was found in corneal scars, spontaneous iritis and detachment of the retina and when a low grade chronic alteration in the metabolism had existed over the longest period. The least proliferation occurred with in-



traocular tumors and glaucoma. (28 figures.)  
Beulah Cushman.

Sobhy Bey, M. **My method of cataract extraction.** *Ophthalmologica* 116:38-42, July, 1948.

The professor emeritus at the hospital Kasr-el-Aini in Cairo (Egypt) describes the technique of cataract extraction at which he arrived after 40 years of extensive practical experience. Until 1926 his method of choice was the extracapsular extraction of mature cataracts. A trip to Barcelona in 1926 revolutionized his technique and he became an ardent follower of Barraquer. Sobhy Bey describes his procedure as follows. A patient with bilateral advanced cataract is operated upon when the vision of the better eye becomes too bad to follow his profession. The eye with the advanced cataract (which is usually mature) is operated on by the extracapsular method. A V-shaped incision is made in the anterior lens capsule by means of the cystotome and the piece of capsule thus outlined is removed with a toothed forceps. After expression of the nucleus the anterior chamber is thoroughly irrigated. As soon as this eye has become quiescent, the second eye is operated upon by the intracapsular method. If the patient has only one eye and the indications are against total extraction (as in high myopia), the extracapsular extraction method is used, and that after repeated discission in order to be certain of the complete ripeness of the lens.

Peter C. Kronfeld.

Venco, Luigi. **A "two-stage" capsulolenticular cataract extraction.** *Ann. di otal. e clin. ocul.* 73:428-438, July, 1947.

Venco describes and discusses his modification of the intracapsular method of extraction with forceps. The cataract is removed in two stages at a single oper-

ation. First a large peripheral capsulotomy is done above along the margin of the widely dilated pupil, and the lens substance is removed by pressure and irrigation; then the capsule is grasped with a special forceps and extracted. In the majority of cases the entire capsule can be removed, but the operative result is satisfactory if only enough of the capsule is removed to leave clear the pupillary area. This operation is especially recommended when the unruptured capsule is hard to grasp. If the capsule ruptures when it is grasped in the course of the usual method of intracapsular extraction, the operation may be satisfactorily concluded by this two-stage method. (2 figures.)

Harry K. Messenger.

Wynne Parry, T. G. **Post-operative security in cataract operation.** *Brit. J. Ophth.* 33:128-129, Feb., 1949.

The author uses a catgut, purse-string suture for closure of a complete conjunctival flap in cataract operations.

Orwyn H. Ellis.

## 11

### RETINA AND VITREOUS

Alvares Pires, Ari. **Inferoversion of the retina.** *Rev. brasil. de oftal.* 7:75-86, Dec., 1948.

Two cases are reported. The first patient was a man of 32 years, who at the age of 16 years had developed cataract in the right eye as the result of an explosion, but had obtained a fair visual field after extracapsular extraction. Two weeks ago this eye had lost its vision without apparent cause. The detached retina lay almost entirely below the horizontal line, depending from a promontory which corresponded to the optic disc. No vessels could be seen. There was a line of tear in the upper inner quadrant. The sec-



ond patient had received a kick in the right eye during a football match, and the retinal condition was apparently somewhat similar to that of the first patient.

W. H. Crisp.

Alvares Pires, Ari. **Cyst of the vitreous.** *Arq. brasil de oftal.* 11:133-134, 1948.

Routine ophthalmoscopic examination in a man of 23 years disclosed a black spot in the lower part of the pupillary area. With the slitlamp the spot was found to be pigmented, about 1 mm. in diameter, and attached to the lowest third of the posterior lens capsule. The vitreous adjacent to the lower pole of the cyst contained numerous scattered pigment points resembling those of the cyst. There were no remains of the hyaloid artery. The author accepts Uribe Troncoso's opinion that the pigment deposits in the vitreous originate in the uvea.

W. H. Crisp.

Arruga, H. **How can we improve the operative results of surgical detachment?** *Arch. Soc. oftal hispano-am.* 8:1085-1089, Nov., 1948.

The percentage of successful surgical results can be raised by attention to certain details. In vitreous hemorrhage, not part of recurrent retinal hemorrhages in the young, retinal detachment should be suspected, and the patient put to bed. Once a diagnosis is made a binocular bandage is of undoubted value in arresting the extension of the detachment. Direct and indirect ophthalmoscopy should be used to find the hole and study it in detail. Arruga implies that the value of indirect ophthalmoscopy is not appreciated in the United States, and that failure to make use of it accounts for some of our surgical failures. In early cases, with slight detachment at the level of the hole and good pupillary dilatation operation should be done promptly. An inflam-

matory reaction and pupillary rigidity are indicative of a mild uveitis, and operation should be postponed until these symptoms subside. In general, operation should be performed at the time when the detachment is minimal. Marked detachment at the level of the retinal hole is an indication for delay until the detachment flattens and the retina becomes reappplied. Eyes with large holes and disinsertions do not improve on rest in bed, and immediate surgery is indicated. When there is failure of the retina with a small hole to become reappplied after rest in bed the prognosis is poor, since it is evident that the choroid's capacity for absorbing the subretinal exudate is impaired. If after 18 or 20 days of bed rest the retina has not reappplied, further delay is useless, although surgical success is improbable. An extension of the detachment in spite of rest in bed is an indication for delaying operation lest the choroid may not absorb the subretinal exudate, or perhaps respond with an inflammatory reaction. Absolute postoperative rest in bed is essential, and its duration is determined by the structural changes in the coagulated area. The development of an adhesive retinohoroiditis is indicated by the appearance of pigment in the gray coagulated zone. When being transported patients should be seated so that the jars of the vehicle are not transmitted to their head.

Ray K. Daily.

Babel, J. **Senile macular pseudotumors.** *Ann. d'ocul.* 181:613-620, Oct., 1948.

In senile disciform and allied retinopathies the following stages occur. An edema begins at the posterior pole and involves the choriocapillaris and lamina vitrea. Irregularities in Bruch's membrane, hyaline band-like deposits in the choroidal capillaries, and local elevations in the pigment epithelium appear. The

hyalin may penetrate the subadjacent exudate with resulting vascular perforations. It may also provoke new exudates with resulting proliferation of fibroblasts and scar tissue. The consequent vascular sclerosis may also be associated with degenerative changes of the circinate type. The frequent hereditary tendency shows that constitution is an important factor. Several illustrative cases are presented.

Chas. A. Bahn.

Babel, J. **The histologic development of the senile pseudotumor of the macula.** *Ophthalmologica* 116:277-278, Oct.-Nov., 1948.

The primary changes are in the lamina vitrea and in the choriocapillary layer. The lamina undergoes irregular thickening and hyaline spurs extend into the choriocapillary layer. On the other side of the lamina an exudate forms which lifts the pigment epithelium off the lamina. The latter becomes permeable to cells and capillaries. The whole disease may be due to a selective sclerosis of the choroidal vessels.

Peter C. Kronfeld.

Ballantyne, A. J. **The state of the retina in diabetes mellitus.** *Tr. Ophth. Soc. U. Kingdom* 66:503-543, 1946.

The progressive changes in diabetic retinopathy are described and the finding in 178 patients out of 561 diabetics are exhibited.

The duration of the diabetes is of the greatest consequence, whereas the treatment with insulin is not. The typical retinopathy may occur in patients in whom the blood sugar had been controlled without insulin. Of 170 patients with diabetic retinopathy 120 had diastolic pressure of less than 100 mm. Hg and only 50 above that level. Probably a chronic stasis on the venous side of the retinal circulation produces anoxia and nutritional changes in the walls of the

capillaries and veins. About one-third of the diabetic patients develop pathologic changes in the retina.

Beulah Cushman.

Bedell, A. J. **Ophthalmoscopy and operations for reduction of high blood pressure.** *Arch. Ophth.* 40:483-492, Nov., 1948.

"At the beginning of any consideration of hyperpiesia it must be understood that the vast majority of patients with hypertension present no lesion of the fundus. This statement cannot be repeated too often." The ophthalmologist should be able to state with reasonable certainty whether a given fundus pattern indicates a favorable postoperative outcome, one of doubtful value, or a disappointing result. He must know the life history of the retinal variations and estimate the life expectancy of the individual patient. If the patient has no serious involvement of the heart, kidneys or cerebral vessels and no retinopathy, the ophthalmologist can sanction operation. If a retinopathy is present, with cotton wool patches, hemorrhages and exudates, approval may be given only when the results of physical and laboratory tests seem to warrant an operation, with the expectation that life will be lengthened. If the patient has definite arteriosclerosis, as indicated by white-walled vessels; if he has round, deep, red, granular retinal hemorrhages; if there is considerable retinal edema, as evidenced by a decrease in the visibility of the retina, or if there are intense, widespread edema of the retina and obscuration of the margins of the discs, with or without newly formed vessels on or about the disc; if there has been recent closure of a retinal artery or vein, operation is contraindicated. If there is marked papilledema with narrowing of the arteries or fulness of the veins, operations should be opposed.

Ralph W. Danielson.

Blum, J. D., and Babel, J. **The histologic differences between true and pseudo-retinitis pigmentosa.** *Ophthalmologica* 116:261, Oct.-Nov., 1948.

In the true degenerative forms of retinitis pigmentosa the primary site of the process is in the cells of the visual neuroepithelium. All other changes are secondary developments. Pseudo-retinitis pigmentosa comprises the chorioretinal diseases due to lues, scarlet fever, measles, vaccination or German measles of the mother. In the latter condition the primary retinal change is in the pigment epithelium. In the other postinflammatory retinal diseases the retinal vessels are primarily involved. Peter C. Kronfeld.

Blum, J. D., and Babel, J. **Differential histologic diagnosis of retinal and pseudo-retinal pigmentary degeneration.** *Ann. d'ocul.* 181:468-474, Aug., 1948.

In primary retinal pigmentary degenerations the neuro-epithelium is primarily involved; in the secondary group it may or may not be involved histologically. The successive stages are usually neuroepithelial degeneration, pigment proliferation with migration toward the inner retina, vascular changes with shrinkage, disorganization of the inner retinal layers, gliosis, and atrophy of the retina and disk. In secondary pigmentary involvements, the neuroepithelium is frequently only slightly involved. After fetal rubeola the clinical appearance of the retina may resemble primary pigmentary retinosis, but histologically, the condition

is usually nonprogressive and the neuroepithelium is less damaged. A clinically similar picture is the salt and pepper fundus that is usually associated with congenital lues, in which the neuroepithelium is secondarily involved. (6 figures.) Chas. A. Bahn.

Boyden, R. C., and Kettering, H. A. **Occlusion of the center retinal vein; report of a case treated with heparin.** *U.S. Nav. Med. Bull.* 48:912-913, Nov.-Dec., 1948.

Heparin therapy was begun 24 days after the onset of thrombosis of a central retinal vein and was given for nine days. Clotting time was kept as close to twenty minutes as possible. Vision on admission to the hospital ten days after the onset was 20/300; 28 days later it was 20/200 in the periphery and 20/300 centrally. The authors suggest further studies using 100 mg. every four hours for the entire day and night. H. C. Weinberg.

Busacca, A. **Retinal lesions caused by lightning.** *Ophthalmologica* 116:141-143 Sept., 1948.

Busacca describes and depicts the ophthalmoscopic findings in a case of central retinopathy caused by lightning. The lesion consisted of edema of the macula with stellate opacities and a small detachment. The author wonders whether the lesion is to be ascribed to the electrical discharge or to the dazzling of the dark-adapted eye.

Peter C. Kronfeld.

## NEWS ITEMS

Edited by DONALD J. LYLE, M.D.  
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month

### DEATHS

Dr. Julian Baker Blue, Memphis, Tennessee, died January 25, 1949, aged 64 years.

Dr. Louis Bothman, Chicago, died January 19, 1949, aged 55 years.

Dr. Robert James Curdy, Kansas City, Missouri, died December 15, 1948, aged 80 years.

Dr. Jule T. Elz, Saint Louis, Missouri, died April 22, 1949, aged 53 years.

### ANNOUNCEMENTS

#### ORTHOPTIC INSTRUCTION COURSE

For details concerning the second annual course of instruction for orthoptic technicians, the first part of which will be given at Nasson College, Maine, June 25 to August 27, 1949, write to the American Orthoptic Council, 1605 22nd Street, N.W., Washington 8, D.C.

### MISCELLANEOUS

#### TO BE ACADEMY GUEST

Sir Stewart Duke-Elder has accepted an invitation to be the guest of honor of the American Academy of Ophthalmology and Otolaryngology and will attend the October meeting.

#### WANTED SERIES I AND II OF THE JOURNAL

The JOURNAL would like to purchase volumes 1 and 2 of Series I of the American Journal of Ophthalmology and volumes 1 to 7 of Series II. Address communications to the Ophthalmic Publishing Company, 664 North Michigan Avenue, Chicago 11, Illinois.

#### NEUROMUSCULAR CONFERENCE

The 21st semiannual conference in neuromuscular anomalies of the eyes was held at the Children's Memorial Hospital, Chicago, on May 1st to 6th by Dr. George P. Guibor and Dr. Charles Bahn.

### SOCIETIES

#### ORTHOPTIC GROUPS MEET

The meeting of the midwestern group of the American Association of Orthoptic Technicians was held in Chicago on April 30th and May 1st, at the Eye Clinic Northwestern University Medical School.

The eastern group met in Rochester, New York, on May 2nd and 3rd. The program meeting was held at Strong Memorial Hospital, and a tour was conducted through the Bausch & Lomb factory.

On May 2nd and 3rd, the southern group met at the Henry Grady Hotel in Atlanta, Georgia.

#### NEW YORK ALUMNI MEET

The New York University College of Medicine-Bellevue Hospital Ophthalmological Alumni Association held its alumni meeting at the New York University College of Medicine on April 18th, 19th, and 20th.

#### LOS ANGELES OFFICERS

The Los Angeles Society of Ophthalmology and

Otolaryngology has elected the following officers for 1949: President, Dr. Warren A. Wilson; secretary-treasurer, Dr. Victor Goodhill; chairman of section on ophthalmology, Dr. George Landegger; secretary of section on ophthalmology, Dr. Harold B. Alexander; chairman of section on otolaryngology, Dr. Alden H. Miller; secretary of section on otolaryngology, Dr. Leland R. House.

The meetings are held at 6 P.M. on the fourth Monday of each month from September to May at the Los Angeles County Medical Building, 1925 Wilshire Boulevard.

#### MILWAUKEE PROGRAM

The March meeting of the Milwaukee Otolaryngological Society was held at the Milwaukee County Hospital. The department of otolaryngology presented two papers: "Bilateral facial paralysis," and "Aberrant lingual thyroid gland." Members of the department of ophthalmology spoke on: "Symposium on angiograms: Aneurysm of the circle of Willis," and "Bilateral homonymous hemianopia." The discussion was in charge of the department of neurosurgery.

#### RENAME PALESTINE SOCIETY

The Palestine Ophthalmological Society (chairman, Dr. Aryeh Feigenbaum, 15 Abyssinian Street, Jerusalem; secretary, Dr. E. Sinai, 9 Bialik Street, Tel-Aviv) has been renamed the Israel Ophthalmological Society.

#### HOLD JOINT MEETING

The 91st meeting of the Reading Eye, Ear, Nose, and Throat Society was held jointly with the Wilkes-Barre Ophthalmological Society. Clinics were held at the Jefferson Hospital Medical School, Philadelphia, under the direction of Dr. William T. Hunt, Jr., assistant professor of ophthalmology, Jefferson Medical College.

Papers presented at this meeting were: "Physiology of the extraocular muscles," Dr. Arno E. Town; "Detachment of the retina," Dr. James S. Shipman; "Field defects and intracranial pathology," Dr. William T. Hunt, Jr.; "Central field changes as shown by angioscotometry," Dr. N. A. Karakashian; "The treatment of gliomas by radium applicator," Dr. Joseph Waldman; "Dacryocystitis," Dr. Alvin W. Howland; "Ocular therapeutics," Dr. Irving H. Leopold; "Secondary glaucoma," Dr. Carroll R. Mullen.

#### CÓRDOBA SOCIETY OFFICERS

The Sociedad de Oftalmología de Córdoba (Argentina) has elected the following officers to serve for the next two years: Chairman, Dr. Roberto Obregón Oliva; secretary, Dr. Alberto Urrets Zavalia (hijo); treasurer, Dr. Roque A. Maffrand; directors, Dr. Rodolfo Laje Weskamp and Dr. Marcos H. de Anquin.

All correspondence should be directed to the secretary at 27 de Abril 255, Córdoba, Argentina.





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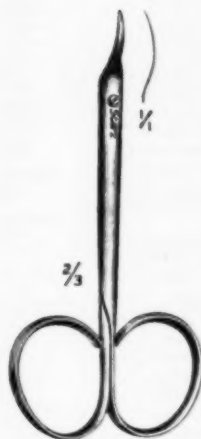
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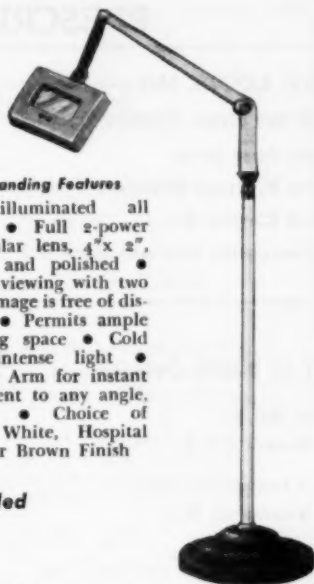


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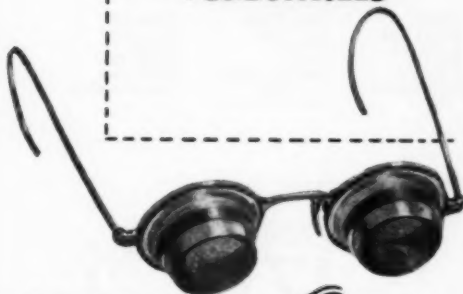


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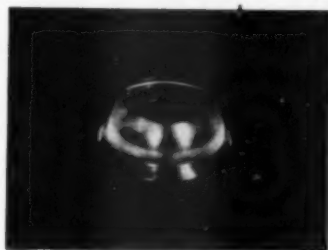
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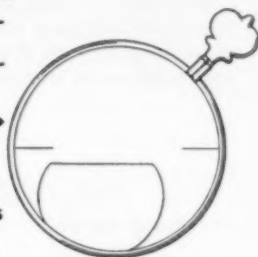
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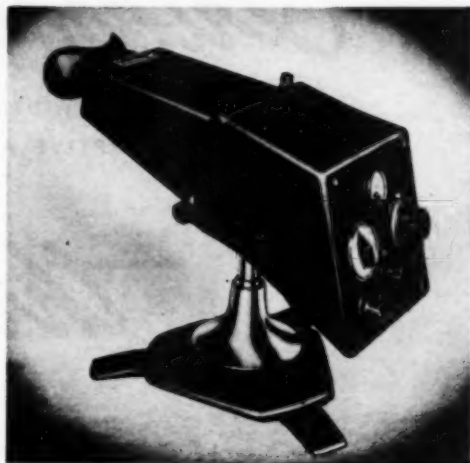


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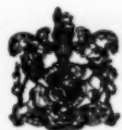
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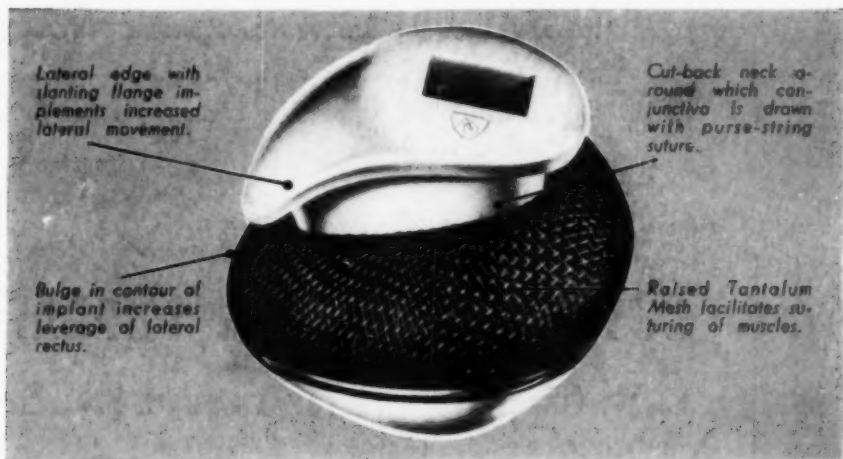
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